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# NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

## RAILROAD ACCIDENT REPORT

FIRE ONBOARD AMTRAK PASSENGER TRAIN  
TRAIN NO. 11, COAST STARLIGHT  
GIBSON, CALIFORNIA  
JUNE 23, 1982

NTSB / RAR-83 / 03

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16. Abstract <p>About 1:35 a.m., on June 23, 1982, Amtrak passenger train No. 11, the Coast Starlight, with 307 persons onboard and consisting of 10 cars operating on Southern Pacific Transportation Company track, stopped at Gibson, California, after fire and dense, heavy smoke was discovered in a sleeping car. The passengers in two sleeping cars were evacuated. As a result of the smoke and fire, 2 passengers died, 2 passengers were injured seriously, and 57 passengers and 2 train crewmembers were treated for smoke inhalation. Five persons were admitted to the hospital. Damage was estimated at \$1,190,300.</p> <p>The National Transportation Safety Board determines that the probable cause of this accident was the lack of effective response to suppress a fire, in bedroom No. 1 of car No. 32010 (1130), and the continued operation of the heating-venting-air conditioning system which resulted in propagation of the fire and smoke. Contributing to the loss of life, injuries, and damage were the lack of definitive emergency procedures and inadequate training for onboard Amtrak service and supervisory personnel and Southern Pacific Railroad Company operating crewmembers in fire emergency procedures and the evacuation of passengers. Also contributing to the loss of life, injuries, and damage was heavy and toxic smoke generated by the combustion of flammable materials, such as plastics and elastomers.</p>			
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**NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D.C. 20594**

**RAILROAD ACCIDENT REPORT**

**Adopted: April 19, 1983**

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**FIRE ONBOARD  
AMTRAK PASSENGER TRAIN NO. 11, COAST STARLIGHT,  
GIBSON, CALIFORNIA  
JUNE 23, 1982**

**SYNOPSIS**

About 1:35 a.m., on June 23, 1982, Amtrak passenger train No. 11, the Coast Starlight, with 307 persons onboard and consisting of 10 cars operating on Southern Pacific Transportation Company track, stopped at Gibson, California, after fire and dense, heavy smoke was discovered in a sleeping car. The passengers in two sleeping cars were evacuated. As a result of the smoke and fire, 2 passengers died, 2 passengers were injured seriously, and 57 passengers and 2 train crewmembers were treated for smoke inhalation. Five persons were admitted to the hospital. Damage was estimated at \$1,190,300.

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**INVESTIGATION**

**The Accident**

At 11:17 a.m., on June 22, 1982, Amtrak train No. 11, the Coast Starlight, consisting of 2 locomotive units and 10 bilevel superliner passenger cars, departed Seattle, Washington, en route to Los Angeles, California. Between Seattle and Portland, Oregon, the train was operated over Burlington Northern Railroad Company (BN) tracks by 6 BN operating crewmembers and 13 Amtrak onboard service personnel. At Portland, the BN operating crew was relieved by a six-man crew employed by the Southern Pacific Transportation Company (SP) for operation of the train over SP tracks. The Amtrak personnel, who worked between Seattle and Los Angeles, were not affected by the operating crew change. At 10:13 p.m., the train arrived at Klamath Falls, Oregon, where the train crew was changed. The train departed Klamath Falls and proceeded to Dunsmuir, California, where the engine crew was changed. The train departed Dunsmuir at 12:50 a.m., June 23, 1982. The SP's prescribed airbrake tests were performed at Klamath Falls and Dunsmuir, and no exceptions were taken to the mechanical or operational condition of the train.

Two sleeping cars were located at the rear of the train. (See figure 1.) For identification, the loading designation for the two sleeping cars was 1130 for Amtrak car No. 32010, the second car from the rear, and 1131 for Amtrak car No. 32039, the rear car. Each car had 15 upper level bedrooms and 6 lower level bedrooms. (See figure 2.) There were 34 persons in the 1130 car, and 35 persons in the 1131 car. No passengers were assigned to bedroom No. 1 in the 1130 car. However, two Amtrak employees and other persons were in the bedroom for a short time just before and until the train stopped in Klamath Falls. The two employees met to discuss some aspects of the business, and the other persons stopped to chat just to be sociable.

About 1:30 a.m., the car attendant in the 1130 sleeping car discovered a fire in bedroom No. 1 on the car's upper level. At that time, she did not close the door to bedroom No. 1, shut off the heating-venting-air conditioning fan system, or use the fire extinguisher, which was located across the hallway about 6 feet from bedroom No. 1, in an attempt to extinguish the fire. Instead, she ran downstairs to the control panel for the train intercom system and called the conductor for assistance, saying twice, "Will the conductor please come to the 30 car?" She then began knocking on the lower level bedroom doors to awaken the passengers and began yelling, "There's a fire, get out." She then went to the upper level and moved toward the rear of the car, knocking on doors and yelling, "Fire, get out." She said that when she moved past the vicinity of bedroom No. 1, the door was open and flames were coming out the top of the doorway of the bedroom.

As the 1130 car attendant moved toward the 1131 car at the rear of the train, she met the rear brakeman coming forward through the end door of the car. She told him about the fire, and he radioed the conductor to stop the train saying, "We have a fire back here." Shortly afterward, the rear brakeman again radioed the conductor saying, "This fire is pretty big; we'd better stop." The rear brakeman continued toward the front of the 1130 car, knocking on doors and shouting, "Fire." The 1130 car attendant continued toward the rear of the 1130 car, exited through the car's upper level end doors, and proceeded down to the lower level of the 1131 car to awaken the 1131 car attendant, who was taking her rest period in bedroom No. 14. By that time, the train had been stopped, and the 1130 car attendant detrained from the right vestibule door of the car 1131. (See figure 1.)

The engineer said that when he overheard the first radio transmission between the rear brakeman and the conductor, about 1:34 a.m., train No. 11 was moving about 25 mph near the north end <sup>1/</sup> of Gibson, California, between the switches of a side track. The engineer said that, when he overheard the rear brakeman's second transmission, he applied an initial service brakepipe reduction in the event he was asked to stop the train. At 1:35 a.m., when he overheard a third transmission, the engineer applied the brakes and stopped the train. Moments later, the conductor instructed the engineer to stop the train, but by that time it already had been stopped.

The engineer said that he and the fireman looked northward at the train, which was standing in a left-hand curve in the direction of travel. (See figures 3 and 4.) They could see a yellowish light in the upper part of the 1130 car that was unlike the normal light reflected from a rail passenger car. When the engineer became aware of the magnitude of the fire, he radioed the dispatcher to send emergency fire assistance. Later, the conductor instructed him over the radio to make the moves required to separate the two rear cars in the train. The engineer said that he assigned the locomotive fireman the task of shutting off the electrical power to the train before the cars were uncoupled. The

<sup>1/</sup> The SP tracks extends geographically north and south between Klamath Falls, and Redding, California. Geographical directions will be used in this report.

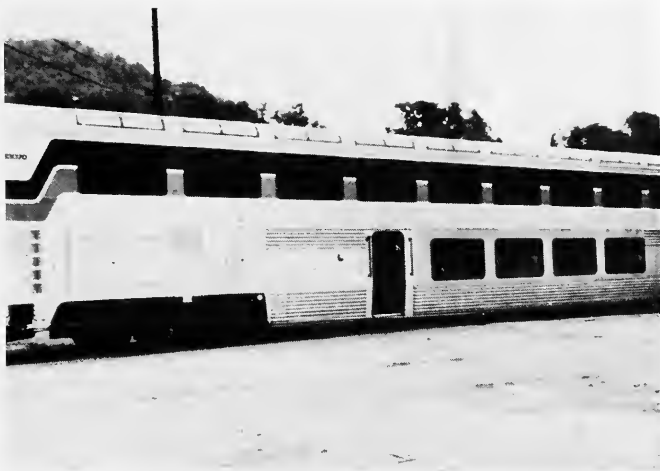


Figure 1.--Amtrak superliner sleeping car.

engineer said the flames broke through the car "long" before the firefighting equipment arrived. (See figure 5.)

After detrainning, the 1130 car attendant moved forward to the 1130 car, where she opened the right vestibule door and assisted passengers standing in the vestibule to detrain. The left vestibule door was then opened, and passengers began leaving the car from both sides. Meanwhile, the 1131 car attendant went to the upper level of the 1131 car and began knocking on bedroom doors. She instructed a passenger in bedroom No. 7 to "yell and knock at every door and tell passengers to get out." Before leaving the upper level, she knocked on the door of bedroom A, which was occupied by a handicapped passenger, 2/ and told the passenger, "Get out of there, there is a fire." She said that the passenger responded, "Why?," but she left before she saw the door open. She assisted passengers to the lower level, opened the two vestibule doors to allow them to detrain, and remained at the lower level to assist passengers. According to the 1131 car attendant, some passengers from the 1130 car detrained through the vestibule of the 1131 car. During this time, she said she was "yelling" that she had a handicapped passenger in bedroom A and for someone to please go up and help him. The 1131 car attendant said that by the time the vestibule was empty of passengers, the car was too smoky for her to reenter it, so she detrained and directed passengers to move away from the immediate vicinity of the sleeping cars.

When the 1130 car attendant and the rear brakeman became aware that a handicapped passenger was in bedroom A of the 1131 car, they climbed the rear (relative to direction of movement) end of the 1131 car to the upper level and attempted to enter

2/ As a result of a stroke, the male passenger in bedroom A of the 1131 car wore a brace on one leg. He could walk with some difficulty and had required assistance when he boarded the train. Despite his handicap, he had not requested passage in the handicapped bedroom.

NOTE: Arrows indicate location of emergency exit windows and doors.

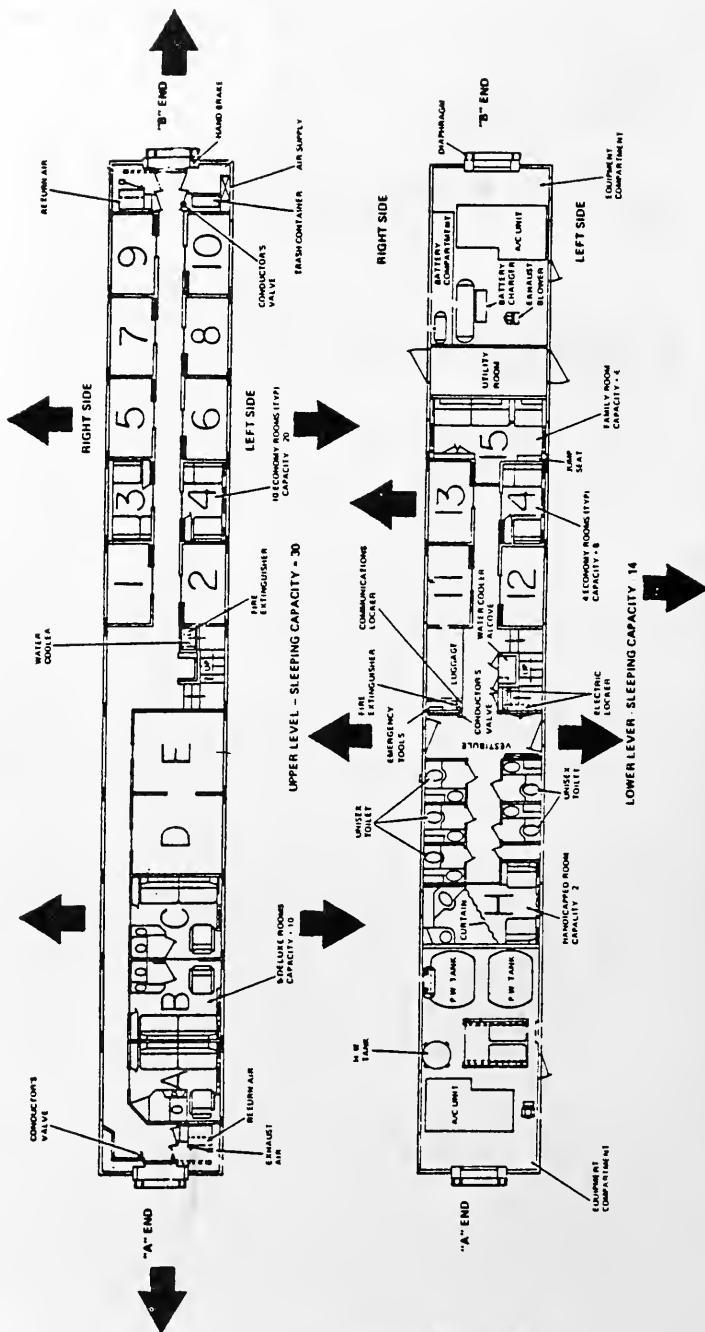
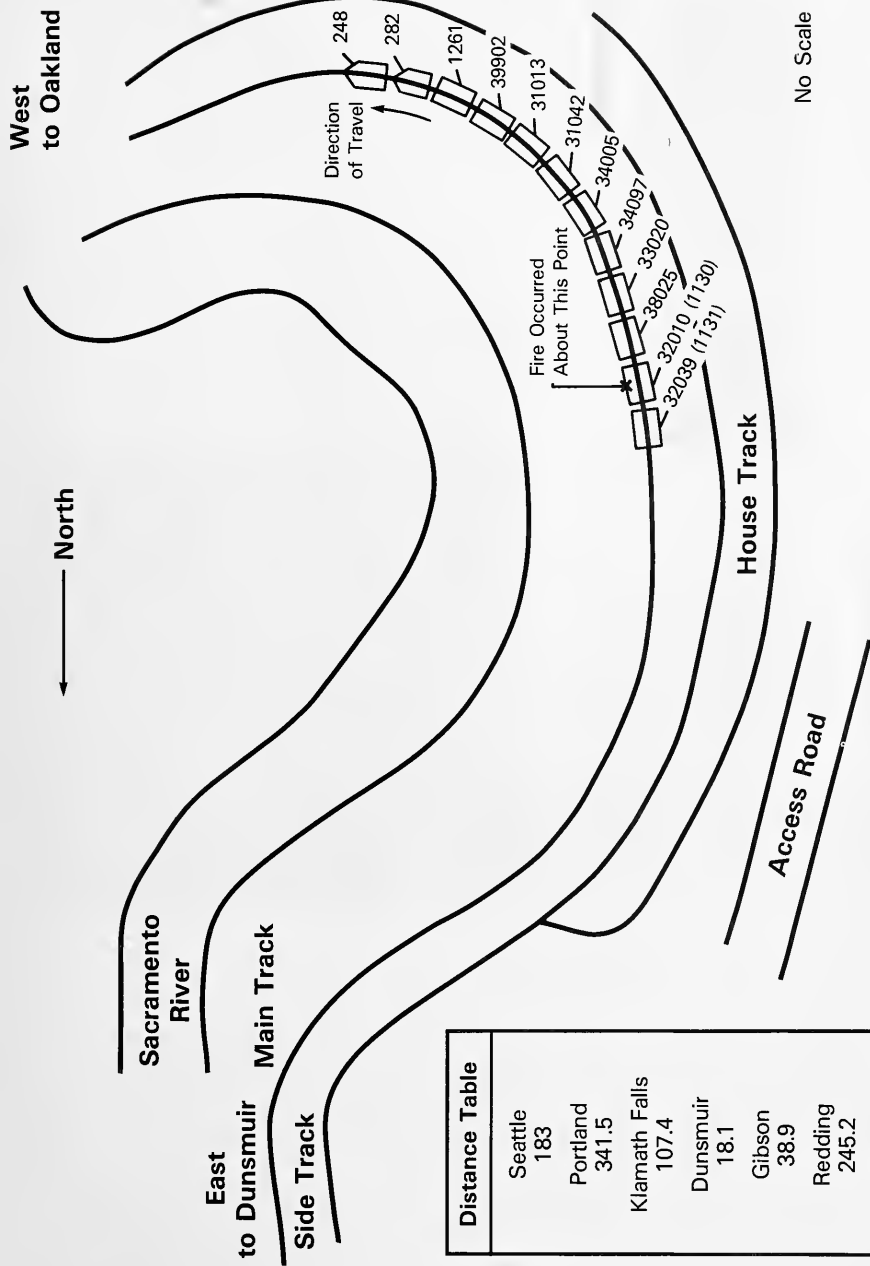


Figure 2.--Typical interior arrangement of the 1130 and 1131 sleeping cars.





Distance Table	
Seattle	183
Portland	341.5
Klamath Falls	107.4
Dunsmuir	18.1
Gibson	38.9
Redding	245.2
Oakland	

Figure 3.--Plan view of accident site.





car during fire.

passenger. However, the car ended with a key to prevent its in the door until he obtained a back smoke poured through the lid not enter the car. After the attendant entered the 1131 car the passenger from bedroom ded to bedroom A. Before the passenger told the 1130 car the handicapped passenger out then retreated from the upper the assistance of a passenger, y resuscitation (CPR) to the he assisting passenger. Other assisted in the evacuation.

1 7:00 and 7:30 p.m., a couple saw two Amtrak supervisory engner Services and a Quality ed across the hall from their st three other persons stopped bedroom was vacated about 1 their bedroom door because





Figure 4.--Gibson, California.





Figure 5.--View of front end of the 1130 car during fire.

the car through the upper level end door to rescue the passenger. However, the car end door, which was also the end of the train, had been locked with a key to prevent its opening by passengers. The rear brakeman could not open the door until he obtained a coach key. When the door eventually was opened, thick black smoke poured through the door and the 1130 car attendant and the rear brakeman could not enter the car. After the 1131 car was separated from the car ahead, the 1130 car attendant entered the 1131 car from the vestibule and crawled toward bedroom A, while the passenger from bedroom No. 7 of the 1131 car entered the front end door and proceeded to bedroom A. Before the 1130 car attendant reached bedroom A, the assisting passenger told the 1130 car attendant that he had reached the bedroom and was taking the handicapped passenger out through the front end of the car. The 1130 car attendant then retreated from the upper level, exited the car through the lower vestibule, and with the assistance of a passenger, who was a medical doctor, administered cardiopulmonary resuscitation (CPR) to the handicapped passenger who by then had been removed by the assisting passenger. Other train crewmembers, Amtrak employees, and passengers also assisted in the evacuation.

#### Witness Statements

Passengers, Bedroom No. 2 of the 1130 Car.--Between 7:00 and 7:30 p.m., a couple occupying bedroom No. 2 on the upper level of car 1130, saw two Amtrak supervisory personnel (later identified as the Regional Director-Passenger Services and a Quality Assurance Specialist) enter bedroom No. 1 which was located across the hall from their room. (See figure No. 3.) The couple testified that at least three other persons stopped and talked briefly to the Amtrak personnel before the bedroom was vacated about 9:30 p.m. According to the female passenger, they closed their bedroom door because tobacco smoke from bedroom No. 1 began to annoy them.

About 12:30 a.m. the female passenger passed bedroom No. 1. She did not see, hear, or smell anything unusual in the area. After she returned to the bedroom, the couple "drifted off" to sleep, but awoke shortly afterward to find that the train had stopped. When the female passenger looked outside, she saw a man with a flashlight on the ground standing near the bedroom window. The couple opened their bedroom door and found that the hall was filled with smoke. The female passenger left the bedroom first, went down the stairway, and exited the car from the lower vestibule on the right side. The male passenger, who was slower leaving the bedroom, said that by the time he got into the hallway flames were in the upper vestibule area. He crawled down the hallway, entered the dining car, and continued through the dining car into the cafe/lounge car before exiting the cafe/lounge car through the lower vestibule door. The female passenger said that they did not receive any notice to leave the car and that no alarms were sounded to warn them of the danger.

1130 Car Attendant.--The 1130 car attendant said that she saw the Amtrak personnel and their visitors several times as she passed by bedroom No. 1 and that shortly after the train stopped at Klamath Falls at 10:13 p.m. the men left the room.

About 10:30 p.m., the 1130 car attendant left her quarters in bedroom No. 14, located on the lower level of the 1130 car, and passed by bedroom No. 1 on her way forward to the diner. At the time, she did not notice anything unusual in or near the bedroom. About 10 minutes after she arrived in the diner, she returned to the 1130 car and again passed by bedroom No. 1 without noticing anything unusual. She descended the steps to her bedroom where she remained until the train stopped at Dunsmuir. She believed that while the train was stopped, she passed by bedroom No. 1 while on her way to the diner but did not notice anything unusual. According to the attendant, the conductor had told her earlier that it would be all right for her to take a rest period between 2 a.m. and 6 a.m., but because she had passengers scheduled to detrain between those hours, she had elected to remain awake.

About 12:50 a.m., the attendant returned to her bedroom without seeing or smelling anything unusual in the vicinity of bedroom No. 1. About 30 minutes later while proceeding to the dining car, she smelled something unusual when she reached the top of the stairway but did not think it smelled like smoke. She saw a haze-like formation suspended in the air in the upper vestibule area, and within seconds, saw flames in bedroom No. 1. At the time, she did not close the door to bedroom No. 1, shut-off the ventilating fan system or use the fire extinguisher, which was located across the hallway about 6 feet from bedroom No. 1, in an attempt to extinguish the fire. Instead, she stood there for a few seconds and then, in accordance with instructions she had received during attendant training, she ran downstairs to access the intercom system and called the conductor for assistance. After twice repeating "will the conductor please come to the 30 car," she began pounding on the lower level bedroom doors of the 1130 car to awaken the passengers, began yelling that "there's a fire, get out," and then went upstairs. When the attendant reached the top of the stairs in the area of bedroom No. 1 she said that the bedroom door was open and that she believed that flames were coming out the top of the doorway. She did not linger at the top of the stairs but moved toward the rear of the train, pounding on doors and yelling "fire, get out." In the excitement and the events following the discovery of the fire, the attendant overlooked an elderly female passenger in economy bedroom No. 6 of the 1130 car. She discovered that the passenger was missing later when she began a check of the passengers. According to the attendant, the passenger had required assistance when she boarded the train and several times had appeared to be confused in finding her way about the car.



As the 1130 attendant moved toward the 1131 car at the rear of the train, she met the rear brakeman coming forward through the end door of the car, evidently in response to her intercom message. When he asked her to explain the problem, she told him "there's a fire in bedroom No. 1." The rear brakeman continued on toward the front of the car. The 1130 car attendant said that by the time she reached the 1131 car she had begun to feel the affect of the smoke. She proceeded to the lower level and awakened the 1131 car attendant, who was taking her rest period in bedroom No. 14. By that time, the train had stopped and the 1130 car attendant detrained from the right vestibule door of the 1131 car (right referenced to the forward direction of the train or the bank side of the railroad.)

She then moved forward to the 1130 car, where she opened the right vestibule door, and assisted passengers standing in the vestibule to detrain. The passengers had not been able to open the vestibule door because they did not know about the safety latch at the top of the door. (Since the attendant could not reach the safety latch from the ground, the 1130 car attendant apparently instructed the passengers on its operation.) At that time, both vestibule doors on the 1130 car had been opened and passengers were leaving the car from both sides. After the rear brakeman, some helpful passengers, and an Amtrak supervisor started helping other passengers to detrain, the attendant entered the lower level of the 1130 car and obtained some towels which she soaked in water so they could be used as filters to aid rescue persons in breathing while they were exposed to the smoke in and around the car; she then detrained.

When the 1130 car attendant and the rear brakeman became aware that a handicapped passenger was still in bedroom A on the upper level of the 1131 car, they climbed up the rear of the car to the upper level and attempted to enter the car through the upper level end door to rescue the passenger. The end car door, which was also the end of the train, had been locked with a key to prevent its opening by passengers. The rear brakeman could not open the door until he had been provided with a coach key. When the door was opened, volumes of thick black smoke immediately emptied through the door, thus, preventing their entry into the car. They discovered later that because the cars were oriented in the train such that the deluxe bedrooms were adjacent to each other, the handicapped passenger had to be reached from the front end of the car. (See figure 1.)

Before another effort could be made to reach the handicapped passenger in bedroom A, the 1130 and 1131 cars were separated from each other and from the train. The 1130 car attendant then entered the 1131 car from the vestibule and crawled on her stomach toward bedroom A, while a male passenger from bedroom No. 7 of the 1131 car entered the forward end door and proceeded to bedroom A. Before reaching bedroom A, the 1130 car attendant was advised by the assisting passenger that he had reached the handicapped passenger and that he was taking the passenger out through the front end of the car. The 1130 car attendant then retreated from the upper level, exited the car through the lower vestibule, and with the assistance of a passenger, who was a medical doctor, administered cardiopulmonary resuscitation (CPR) to the handicapped passenger.

1131 Car Attendant.--After being awakened by the 1130 car attendant, the 1131 car attendant went to the upper level of the 1131 car and began knocking on bedroom doors to awaken the occupants. She instructed the male passenger in bedroom No. 7 to "yell and knock at every door and tell passengers to get out." Before leaving the upper level, she knocked on the door of bedroom A, which was occupied by a handicapped passenger, and told the passenger to "get out of there, there is a fire." She said that the passenger responded with "why," but she did not respond and departed without seeing the door open. By this time, the train had stopped, and she had begun to meet passengers who were

leaving the deluxe bedrooms. She accompanied the passengers to the lower level, opened the two vestibule doors to allow them to detrain, and remained at the lower level to assist passengers. According to the attendant, some passengers from the 1130 car detrained through the vestibule of the 1131 car. During this time, she was "yelling" that she had a handicapped passenger in bedroom A and for someone to help him. The 1131 car attendant said that, by the time the vestibule was empty of passengers, the car was too smoky for her to reenter it, she then detrained and directed passengers to move away from the immediate vicinity of the sleepers.

Rear Brakeman.--The rear brakeman boarded the 1131 car at Klamath Falls. As the train departed, he assisted the engineer in making the required running brake test. About 11:30 p.m., he passed through the 1130 car on his way to see the conductor who was at the front of the train. He said that he did not hear, smell, or see anything abnormal in bedroom No. 1 on his way forward or on his return trip. While the train was stopped in Dunsmuir, he detrained and passed by the 1130 car, but again he did not see, hear, or smell anything unusual.

About 40 minutes after the train departed Dunsmuir, while he was sitting in bedroom D of the 1131 car, he overheard on the intercom system the 1130 car attendant's call to the conductor. He proceeded forward to the 1130 car to check the problem. When he opened the end door of the 1130 car, it was full of smoke. The smoke was so dense that he could hardly see, and he almost ran into the 1130 car attendant after going 25 to 30 feet into the car. When she told him that "we have a problem," the rear brakeman immediately radioed the conductor and told him to stop the train because of the fire. The conductor questioned him about the necessity of stopping the train, but after the brakeman told him that stopping was the best thing to do, the conductor agreed. The rear brakeman then proceeded forward, knocking on doors and shouting "fire." A few people responded with what he described as "screaming and a lot of commotion." He did not see anyone in bedroom E of the 1130 car at that time and could not recall whether or not any of the bedroom doors were open. While passing bedroom No. 1, he did not see any flames or was he aware of any concentration of heat. He said the smoke was extremely dense. He did not attempt to locate a fire extinguisher, or the intercom, the location of which he did not know. Except for his initial encounter with the 1130 car attendant, he did not meet anyone in the hallway.

The rear brakeman said that he continued moving forward "yelling" fire and knocking on "anything he could feel." Although he did not remember exactly how far toward the front of the car he reached, he thought he had made enough noise to have awakened everyone. He then returned to the center of the car and descended the stairway to the lower level. By that time, the train had stopped and passengers were detraining. He said that both vestibule doors were open. He recalled that the car attendant had told him she had opened the doors to let the smoke out.

The rear brakeman said that while he was assisting passengers off the car, he heard some "banging noise" within the 1130 car. He directed the light of his lantern upward and saw a passenger at the window in a lower level bedroom. He went inside the car, found the bedroom in which the passenger was located, and led several occupants of the bedroom out through the vestibule door. He then directed everyone on the left side (riverside) of the train to move to the right side (hill side) of the train.

In response to a passenger's request to search for her husband, the rear brakeman reentered the 1130 car. He said he went to the top of the stairs and called the man's name, but he got no response. At that time, he still did not see any flames although the smoke was extremely heavy and the heat was intense. Also, he was unable to determine

the origin of either the smoke or the heat. After an unsuccessful attempt to locate the missing passenger, he returned to the lower level of the car. Shortly afterward, the rear brakeman, the 1130 car attendant, and the male passenger from the 1131 car, bedroom No. 7, reentered the 1130 car and proceeded to the upper level where they found two passengers whom they led to safety. The rear brakeman then reentered the car and proceeded to the upper level where he found two more passengers, one who was almost incapacitated because of the smoke, and led them to safety.

In another attempt to locate the missing husband for whom he had searched earlier, the rear brakeman, followed by the 1130 car attendant and the passenger from the 1131 car reentered the 1130 car. When they reached the top of the stairs, the 1131 passenger called excitedly, "there's a fire, there's a fire above your head." At that time, they were crawling, attempting to see by the light of the rear brakeman's lantern. When the rear brakeman saw the fire overhead, he said, "we've got to get out of here," They immediately turned around, proceeded to the lower level, and detrained. Later, the missing passenger was found safely on the other side of the train.

The rear brakeman said that he, the 1130 car attendant, and the passenger from the 1131 car moved around the end of the train to the east side, where they met and talked with the conductor and the head brakeman. At that time, the conductor decided to separate the train. An Amtrak Road Foreman of Engines-Diesel Supervisor assisted them in uncoupling and separating the cars from the train. They encountered difficulty in pulling the plug connectors on the electrical cables connected between the cars from their sockets, but after a short time the cables were disconnected, the rear car (1131) was uncoupled, and the front part of the train moved forward, leaving the 1131 car standing alone. When they proceeded to uncouple the 1130 car, they encountered difficulty on one side with the electrical cable plug connector. The head brakeman said the Amtrak supervisor was reluctant to pull the cars apart because he did not want to destroy the cable. However, because the cable plug connector could not be disconnected from the socket, the car was uncoupled and the cable plug connector was pulled loose. The train was moved forward again, leaving about 100 feet between adjacent equipment.

The rear brakeman's testimony confirmed the testimony of the 1130 car attendant that he attempted to enter the 1131 car from the rear end and then at the vestibule, and that he finally climbed to the upper level at the front end of the car and assisted in removing the handicapped passenger from the car. Additionally, he said that he obtained a blanket from the 1131 car to cover the handicapped passenger and provided light with his lantern while first aid was being administered.

Conductor.--The conductor said that, while he was working at his desk in the second car behind the locomotive, he received a message over the train intercom from the 1130 car attendant asking him to come to the 1130 car immediately. He said that immediately thereafter the rear brakeman called him on the radio and told him there was a fire in the 1130 car. He asked the rear brakeman "how bad is the fire," and the brakeman replied "pretty bad." The conductor said that he immediately radioed the engineer to stop the train. He then started toward the 1130 car, accompanied by the head brakeman and a chair-car attendant, who had obtained a fire extinguisher from one of the cars near the locomotive.

The conductor said that he first became aware of smoke in the dining car which was adjacent to the 1130 car. By the time they entered the 1130 car, the train had stopped. When he entered the 1130 car first, followed by the head brakeman and the chair-car attendant, they were engulfed by dense smoke which made it difficult to see or breathe. The conductor said that they looked for the source of the fire but were unable to find it. The fire extinguisher was not used.

The conductor said that when they reached the upper vestibule area the head brakeman went down the stairs to the lower level but returned shortly thereafter and said "lets get out of here." They reentered the dining car and asked passengers if they were aware of anyone who was still in the 1130 car. The conductor did not indicate the response received. The three men then proceeded to the cafe/lounge car, the second car ahead of the 1130 car, asked similar questions of the passengers, proceeded to the vestibule at the lower level of the cafe/lounge car, and detrained. Once on the ground, the conductor saw flames near the center of the ceiling of the upper level of the 1130 car. After considering the possibility of an electrical fire, the conductor called the engineer on his radio and asked him to shut off the electrical power unit. However, when he realized that the electrical shutdown would stop the fans and that the smoke would not be moved out of the cars, he radioed the engineer to restart the power unit.

The conductor said that he considered himself in charge of all activities at the scene. He said that he asked the car attendants if anyone remained on either sleeping car. When he was told that a passenger in bedroom A of the 1131 car was not accounted for, he permitted a passenger to use a handicap boarding platform to gain access to bedroom A from outside the car, but the attempt was unsuccessful. He did not relate how the handicapped passenger was removed from the car. The conductor said that about 1:50 a.m., he decided to separate the 1130 and 1131 cars from the rest of the train and from each other.

While the conductor was engaged in the activities at Gibson, a young man appeared out of the crowd, began following him around, and engaged him in conversation. The young man inquired if he could continue on to Oakland on Train No. 11. The conductor then asked the young man if he was injured, to which he replied no. The conductor then told the man he could continue on to Oakland.

The conductor said the man continued to follow him around and that he noticed the man was carrying an unopened box of pillows that he had removed from the train. When he asked the man what he was doing with the pillows, the man replied that he was going to take them to coach passengers to make them more comfortable. The conductor told him that the coach passengers had an ample supply of pillows and the passengers would not need the pillows. The conductor then determined that the man did not have a passenger ticket and that he had been riding in one of the sleeping cars, but he did not determine which one. The conductor asked the man where he boarded the train, to which he replied Dunsmuir. The rear brakeman said that no one had boarded the train at Dunsmuir. The man then said he boarded the train in Portland, Oregon, that he had an unconfirmed reservation, and that he had been waiting for the conductor to come by so he could purchase a ticket. The conductor told the man to go to the second head car and wait for him and he would sell him a ticket. The man proceeded in that direction. The conductor reported the incident to an SP police officer and asked him to question the man, but no one saw the man again. Neither car attendant, the Amtrak supervisory personnel, nor the SP train crewman saw anyone in either sleeper fitting a description of the unticketed passenger. Some passengers reported that someone whom they believed to be a newspaper reporter was around taking photographs, but the presence of a newsman was never confirmed.

Head Brakeman. --When the rear brakeman broadcast the radio message about the fire, the head brakeman accompanied the conductor to the 1130 car. The head brakeman said that he first detected smoke when he entered the cafe/lounge car, and that when he entered the 1130 car he could neither see nor breathe. (According to his testimony, he entered the 1130 car first, followed by the conductor. He did not know at that time

whether or not the chair-car attendant entered the car.) He said that while proceeding toward the stairway area, he bumped into a woman passenger who he assisted from the car into the dining car. When he walked into the 1130 car, some of the economy bedroom doors were closed. The head brakeman, followed by the conductor and the chair-car attendant, left the 1130 car and went forward to the dining car. According to the head brakeman, they did not question the passengers in the diner about other passengers who remained in the sleeper because they assumed everyone was off. They then descended to the lower level, unlocked the vestibule door on the right (hill) side of the train, and stepped off.

The head brakeman moved to the 1130 car where a number of people were standing on the ground near the vestibule of the car. He said that he made three attempts to get to the upper level of the car via the stairs but the smoke was too dense. After hearing a "rapping" sound on a bedroom window, which he later identified as bedroom A of the 1131 car, the brakeman and two other persons hoisted a man to remove the window. When the man could not release the window moulding, they attempted to break the window with a sledge hammer but were unsuccessful. About the same time, the conductor decided to separate the cars from the train.

The head brakeman said that after the handicapped passenger was brought to the upper level end door, he assisted in lowering the passenger to the ground. In his testimony, the head brakeman said the rescuers for the passenger in bedroom A entered the car through the vestibule door. He also confirmed the conductor's encounter with an unticketed passenger.

Unassigned Passenger, 1131 Car.--An off-duty SP employee, who regularly worked train No. 11 as a rear brakeman, and two of his family members were passengers on the train on June 22-23. The off-duty employee said that, about midnight, he left the coach section of the train and passed through the 1130 car on his way to the 1131 car. He did not see, smell, hear, or feel anything unusual when he passed by bedroom No. 1. While the train was in the station at Dunsmuir, he detrained briefly to assist the rear brakeman open a water control valve on the cafe/lounge car. During this time, he passed by the 1130 car twice. He noticed that the vestibule doors were closed, but he was not attracted to the car by anything unusual. When the train stopped at Gibson, the off-duty employee and his family, who had been riding in bedroom E of the 1131 car detrained via the vestibule door. He said he noted a glow on the left side of the train in the ceiling of bedroom No. 1, of the 1130 car. However, when he moved around the end of the train to the right side of the train to check for fire, he did not see any glow in the car. He said that, during the evacuation procedures, he also tried to reach the passenger in bedroom A of the 1131 car, but he could not move beyond the head of the stairs at the upper level because of the smoke.

Male Passenger, Bedroom No. 7 of the 1131 Car.--The male passenger in bedroom No. 7 said that about 1:30 a.m. his wife was awakened by the 1130 car attendant's announcement over the train's intercom system. About 2 a.m., his wife awoke him because she smelled smoke or some strange odor in the room. No one knocked on the door of their bedroom to awaken them or to advise them of a fire. After dressing, they left the car via the right center vestibule exit. According to the male passenger, the lights were on in the car and the car attendant was in the lower vestibule area. They saw no one on the ground but the conductors.

After other passengers began evacuating the train, the couple noticed that friends who were occupying bedroom No. 8, which was located across the hall from bedroom No. 7, had not detrained. To get the attention of the Amtrak employees who were standing nearby, his wife said loudly that their friends were still in car 1131. However, after the Amtrak employees did not respond to her remark and make a rescue effort, the male passenger returned to the car, located the two friends and led them and four other passengers to safety. The male passenger said that at the time, the cars had been separated and that two persons whom he identified as Amtrak supervisors, were looking at an upper level window in the 1131 car. When he inquired about their interest there, he was told that a semiparaplegic gentleman was still in bedroom A. After obtaining a wet towel for his face, he climbed the end of the 1131 car and entered the car three times before he located the passenger huddled unconscious against the outside wall. After dragging the unconscious passenger from the bedroom to the end of the car, two men assisted in getting the passenger to the ground where he was immediately administered CPR.

When Safety Board investigators questioned the male passenger about how he recognized a conductor and Amtrak supervisors, he said that they were wearing red clothing, but as an afterthought, he said that they were probably Amtrak service personnel, rather than the conductor or Amtrak supervisors. The passenger said that, according to his wife, the male passenger in bedroom A was removed from the train at 2:20 a.m, and the first firefighting equipment arrived at 2:40 a.m. When his wife asked the 1130 car attendant why they were not alerted to the fire, the attendant responded, "We did not want to panic anyone." The couple was critical of the lack of a warning and evacuation activities involving the 1131 car. According to the passenger's wife, about 3:10 a.m., the 1131 car attendant appeared to be shaken and unable to cope with the situation. She said that, the 1130 car attendant although visibly shaken when she learned of the death of the passenger in bedroom No. 6 of the 1130 car performed her job well.

The Regional Director-Passenger Services, Amtrak.—The Regional Director-Passenger Services had boarded train No. 11 at Seattle. Between Seattle and Gibson, he had walked through the train periodically to observe the Amtrak employees in the performance of their duties. He said he did not take exception to any of the conditions or services he saw performed or to the "housekeeping" on-board.

About 1 hour before the train arrived at Klamath Falls, he and an Amtrak Quality Assurance Specialist sat down in vacant bedroom No. 1 of the 1130 car to talk. The Regional Director-Passenger Services was seated on the south side of the room, riding backward to the train's direction of travel. An Amtrak Assistant Superintendent of Transportation stopped at the bedroom, stood in the doorway, and joined in the conversation for a brief time. A member of the National Association of Railroad Passengers also stopped, sat down in the bedroom, and joined in the conversation for a brief time. Shortly afterward, an Amtrak dining car waiter stopped at the bedroom, stood in the doorway, and joined the conversation. The Regional Director-Passenger Services said that he did not remember smoking in the bedroom, although he does smoke, and that no alcoholic beverages were consumed. He said that to his knowledge the electric heater was not on.

The Regional Director-Passenger Services said that when the train stopped at Klamath Falls at 10:13 p.m., they vacated the bedroom and he detrained for a brief time. At the time, he did not smell any unusual odors or see any unusual conditions in the bedroom. He did not remember whether or not the door was open or closed when he left the bedroom. When he reboarded the train, he retired to bedroom E of the 1130 car, which he shared with his wife.

The Regional-Director Passenger Services said that about 1:30 a.m., he was awakened by the car attendant's announcement over the intercom system to the conductor. He said that at that time, he climbed down from the upper berth, pushed the doorway curtains open, and saw smoke in the hallway. He "yelled" to his wife to get up, that "there is a fire someplace." They hurriedly dressed and proceeded down the hallway, toward the rear of the train, following someone who was "yelling" for everyone to get out. He said that he could not see the source of the smoke which was thick and irritating to the respiratory system and eyes.

After detraining through the center vestibule of the 1131 car, the Regional Director-Passenger Services proceeded to the 1130 car and began assisting passengers to detrain. While he was standing at the vestibule, he still did not hear any crackling sound or see an indication of a fire. He saw the 1130 car attendant on her hands and knees helping people and shouting encouragement to them to come down the stairs where she assisted them to detrain. He estimated that about 10 minutes later, all passengers were out of the car. He and the car attendant tried to keep the 1130 car passengers together on the ground, and at some point, both car attendants made a roll call of the passengers. By the time he became aware of the handicapped passenger in bedroom A of the 1131 car, the passenger was being removed from the car. The Regional Director-Passenger Services said that while the handicapped passenger was being administered CPR, he saw flames erupting from the left side of the 1130 car. He did not participate in separating the train, and he had no knowledge of the unticketed passenger encountered by the conductor.

While at Gibson, the Regional Director-Passenger Services talked with the SP conductor about buses for transporting the passengers to the hospital. He had talked to the conductor earlier in the dining car while the train was between Klamath Falls and Dunsmuir but he did not report any detection of alcohol. Nevertheless, while discussing the buses, he said that he detected "booze" on the conductor's breath but that the conductor's actions or speech did not appear to be impaired. Later, he mentioned the conductor's breath to the Amtrak Assistant Superintendent, who told him that he would report the incident to the SP trainmaster at the scene. The Assistant Superintendent later told the Regional Director-Passenger Services that he had reported the conductor's condition to the SP trainmaster and that an SP Special Agent also had detected alcohol on the conductor's breath. Safety Board investigators later learned that the Assistant Superintendent gave a statement to a private fire investigator for Amtrak and that he actually reported the incident to the SP Special Agent who in turn reported it to the SP trainmaster. He did not specify the time the incident was reported to the special agent or the trainmaster. However, the SP trainmaster gave a statement to a Safety Board investigator that he took no exception to the conductor's condition at Gibson. The Regional Director-Passenger Services said that a final check of the passengers was made as they arrived at the hospital in Redding, and that they were verified as bona fide ticketed passengers.

Road Foreman of Engines--Diesel Supervisor Amtrak.--The Amtrak Road Foreman of Engines-Diesel Supervisor boarded train No. 11 at Portland, Oregon, on June 22, 1982. Before the train reached Klamath Falls, he made several walk-through inspection tours before retiring for the night in the handicapped bedroom on the lower level of the 1131 car. When he was awakened by a "banging" sound on his bedroom door, he was gagging because of smoke in the room. He said he turned on the bedroom light, but the dense smoke limited his vision. He "grabbed" his clothes and proceeded to the stairway where he met other passengers from the upper level descending the stairs. By the time he reached the vestibule, the train had stopped. He stepped to the ground and proceeded forward on the west side of the train to the 1130 car to locate an Amtrak supervisor.

In response to passengers' screaming that people were still inside the 1130 car, he entered the car and went to the top of the stairs where he felt intense heat and encountered extremely dense smoke. He could not locate the source of the heat or the smoke. After helping some passengers down the stairway, he left the car to obtain some air and to overcome nausea. He then returned to the car with a flashlight and a wet towel over his face and proceeded to the top of the stairs. According to the road foreman, the flashlight only penetrated the smoke about 2 feet. Before being forced to retreat and exit the car, he saw flames on the floor of bedroom E which he described as being like a jet of gas flame.

When he returned to the outside, he spoke to the Amtrak Assistant Superintendent about separating the cars to isolate the 1130 car. He located the conductor, discussed the status of the head end power, 3/ and instructed the conductor to shut off the power to stop the spread of fire and smoke. He then radioed the engineer to shut off the power so that he could disconnect the electrical cables between cars to uncouple and separate the cars. When it appeared that the engineer was having trouble accomplishing the shutdown, the road foreman was about to proceed to the locomotive unit to help shut off the power when a discussion developed between him and the Assistant Superintendent about the timeliness for shutting the power off and separating the train. The Assistant Superintendent contended that the lights were needed by the passengers and that movement of the train while passengers were still detraining would be dangerous. The road foreman argued that the lights were of no value because of the dense smoke. About the same time, he saw flames along the ceiling in the upper level of the 1130 car between bedrooms E and No. 1, and some of the windows were beginning to melt. Because he wanted to keep the fire from spreading to other cars, he told the Assistant Superintendent that he was going to separate the cars regardless of what anyone said. By this time, the engineer had succeeded in shutting off the head end power.

The Road Foreman of Engines-Diesel Supervisor, with the conductor directing the movement of the train, proceeded to disconnect the electrical cables and to uncouple the rear cars as described by the rear brakeman and the conductor. By the time the electrical cables were disconnected from the 1130 car, flames were coming out of the vestibule doors.

The Road Foreman of Engines-Diesel Supervisor said that during the uncoupling operation he saw two Amtrak supervisors attempting to identify passengers to determine that everyone was out of the two rear cars. He said that he did not detect any alcohol on the conductor's breath. He remained with the damaged equipment until it arrived at Dunsmuir.

### Emergency Response

The Castella (California) Volunteer Fire Department (CVFD), located some 11 miles away, was notified about the fire on train No. 11 about 1:55 a.m. About 2:15 a.m., CVFD firefighters with four emergency firefighting units arrived at the accident scene. Shortly afterward, more firefighting and rescue personnel arrived. When the CVFD arrived, flames were coming out both ends of the car and through broken windows. After the firefighters applied water to the burning car for 5 to 7 minutes, the fire and heat was reduced, and CVFD firefighters, wearing backpacks containing breathing apparatus, entered the 1130 car from both ends to search for any remaining passengers. The CVFD chief said that he was unable to gain access to the upper level through the vestibule because of the debris which had fallen into the stairwell.

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3/ A 480-volt 3 phase 60 hertz alternator set which furnished the electrical power requirements of the train.



The CVFD chief said that after the fire was extinguished, the 1130 car attendant discussed the accountability of passengers in the 1130 car. He accompanied her into bedroom No. 14 of the 1130 car where she obtained a copy of the passenger manifest. At the time, the attendant told the CVFD chief that everyone had been accounted for. However, a few minutes later, she stopped him and said that she believed an elderly passenger was missing. Shortly afterward, the elderly passenger's body was discovered in bedroom No. 6 of the 1130 car. The handicapped passenger who had been rescued from bedroom A of the 1131 car also died at the scene, following attempts by rescue personnel to revive him.

### Injuries to Persons

<u>Injuries</u>	<u>Traincrew and Amtrak Service Personnel</u>	<u>Passengers</u>	<u>Others</u>	<u>Total</u>
Fatal	0	2	0	2
Serious	0	2	0	2
Minor	2	57	0	59
None	17	227	0	244
Total	19	288	0	307

### Damage

The upper level of sleeper car No. 32010 (1130) was destroyed; the lower level was damaged by the intense heat and smoke. (See figures 6, 7, and 8.)

Sleeper car No. 32039 (1131), cafe/lounge car No. 33020, and diner car No. 38025 were damaged by the smoke. Equipment damage was estimated as--

Cafe/lounge car No. 33020	\$ 12,700
Diner car No. 38025	85,000
Sleeper car No. 32010 (1130)	1,000,000
Sleeper car No. 32039 (1131)	92,500
Total	<u>\$1,190,300</u>

### Personnel Information

The six-man operating crew of Amtrak train No. 11 were SP employees. Each was qualified for his assignment in accordance with the requirements of the SP operating rules. Before reporting for duty aboard the train, each person had been off duty for the required rest period prescribed by the Federal Hours of Service Law. (See appendix B.)

At 5:25 a.m., after the fire had been extinguished, train No. 11 continued toward its destination and departed Gibson with the undamaged cars. When train No. 11 arrived at Redding about 6 a.m., the conductor was relieved from duty after he refused to submit to a blood alcohol test as requested by the SP supervisor because of suspected intoxication. The conductor was subsequently dismissed after a company investigation on the charge that he had violated SP operating rule "G," which prohibits the use of alcoholic beverages while on duty. The conductor denied the charge. He explained that after train No. 11 departed Gibson, he drank a "cough remedy" offered to him by a passenger because of a cough that he had developed. He said that he did not recognize the cough remedy's taste, but it was bitter and it did not taste like a liquor. According to the conductor, after he was relieved from duty, he purchased a bottle of whiskey and took it to his motel room



Figure 6.--Exterior view of the 1130 car.



Figure 7.--Interior view of burned economy-type bedroom in the 1130 car.



Figure 8.--Interior view of burned economy-type bedroom in car 1130.

where he had a drink. He later went to the hospital for a checkup because he was not feeling well, and while at the hospital, he requested a blood alcohol test. The conductor believed that the test indicated a blood alcohol level of about 0.05 to 0.06 percent. He was not admitted to the hospital. Safety Board investigators did not verify the results of the test because the hospital would not release the information. Because the information available at that stage of the investigation did not indicate that the conductor's alleged use of alcohol affected the immediate events at Gibson, the matter was not pursued.

The car attendants and supervisors onboard train No. 11 were Amtrak employees. (See appendix C.) Until March 1982, the 1130 car attendant had been assigned to Amtrak service on the east coast of the United States where she had trained and worked on Amtrak's Amfleet equipment. A review of the attendant's personnel records revealed that she had been furloughed several times because of seasonal declines in business. During one furlough, she had been employed by American Airlines as a flight attendant and had completed the company's training for flight attendants. After she was recalled by Amtrak, she transferred to a west coast base of operations out of Los Angeles, California in May 1982. She formerly had been employed by a Washington, D.C.-area hospital where she had received training in the administration of CPR.

The 1130 car attendant said that, before transferring to the west coast, she had received in-service training trips on the equipment used on the east coast. The attendant described her training as including serving food, setting up dining cars, and performing tasks that were required when reporting for duty aboard the train. Also, she had received about 2 days of first-aid training. She said that her formal training had lasted about 1 week in coaches, after which she made several student trainee trips. She had been shown the location of the safety emergency tools, the fire extinguisher, and the first-aid kit on the Amfleet, as well as the older equipment that Amtrak had taken over from the

railroads. At the time of the fire, her familiarity with the superliner equipment, which is not used east of Chicago, Illinois, was limited because she had not been trained on the equipment.

According to the attendant, when she transferred to the west coast, she went directly on a trip aboard Superliner equipment with an employee experienced in coach service. She said that on the trainee trip she worked as a coach attendant and assisted a sleeping car attendant. Based on her observations, she knew that fire extinguishers were located on the lower level of the Superliner cars, but she did not know that fire extinguishers were located also on the upper level. She did not know exactly where the emergency windows were, and she had never seen one operated. She understood that the conductor was her immediate supervisor onboard the train.

The attendant described a yellow safety rules book and a blue manual which she identified as "manual Schedule B," as books that she was required to read. Amtrak's training records indicated that the attendant had received 3 days of formal classroom training and 3 days of training on Amfleet or similar equipment, and that she had made student trips during a 9-day period.

The 1131 car attendant completed a training course in May 1980 and then began working onboard Superliner equipment.

The Road Foreman of Engines-Diesel Supervisor and the Regional Director-Passenger Services were qualified for their positions according to Amtrak's requirements. (See appendix C.)

### Train Information

Train Consist.--Amtrak train No. 11 was powered by two EMD F40PH diesel electric locomotive units. The 10-car train of superliner equipment consisted of, in order from the locomotive, one baggage car, one dormitory-coach combination car, two coach-baggage combination cars, two coaches, one cafe/lounge car, one diner car, and two sleeping cars.

The diesel-electric locomotive units were manufactured by the Electro-Motive Division of General Motors Corporation. Each unit was equipped with a combination of airbrakes and dynamic brakes; a multifrequency radio, and a 480-volt, 3-phase, 60-hertz alternator set (HEP) which supplied the electrical power requirements of the train. On June 22-23, the electrical power for train No. 11 was being supplied from the second locomotive unit. The HEP, which was protected by a circuit breaker located between the source of power and the load, could be shut down by a pushbutton and safety lock-out feature located at the engineer's operating position of the unit. When units are coupled in multiple, the HEP in one locomotive unit cannot be controlled remotely from another locomotive unit. The Amtrak Road Foreman of Engines-Diesel Supervisor said that the engineer of train No. 11 apparently did not understand that the electrical power in the second locomotive unit could not be shut off remotely from the lead locomotive unit and that the engineer needed to go back to the second unit of the locomotive to shut off the head end power.

Superliner Equipment.--The Amtrak bilevel superliner cars were manufactured by the Pullman Standard Manufacturing Company, Chicago, Illinois, in the late 1970's for use in the western and midwestern regions of the United States. The design of the car, which

was developed by an independent consulting firm for Amtrak, was based on cars originally built by The Budd Company in the 1930's and 1940's and placed in passenger service on the Atchison, Topeka and Santa Fe Railway. Deviations from the specifications were subject to a mutual agreement between Amtrak and the Pullman Company. The cars were constructed of stainless steel, except for the draft sill and bolster assembly, which was constructed of low-alloy, high-tensile steel. There were structural posts adjacent to all windows, doors, and access openings that were continuous from the lower floor to the car roof. Except along the window lines, the side sheets were corrugated for strength and to provide an aesthetic effect. The ends of the cars were covered with flat sheets of stainless steel.

Entrance to the cars from the outside was via the vestibule doors located near the center of the car at the lower level. Access to the upper level from the lower level was via stairway located in the vestibule area or from the upper level of adjoining superliner cars through the end doors. If superliner equipment is intermixed with conventional equipment, the couplers are compatible but a transition car designed for that purpose must be used to facilitate passenger movement from the floor level of a conventional car through the end doors to the upper floor level of a superliner car. There are no other accessible entrances.

The 480-volt a.c., 3-phase, 60-hertz power for the car's electrical requirements was transmitted from the locomotive via externally connected power cables between cars. Each car had electrical equipment to change the high voltage into 120 volts a.c. power for the lights and control functions. Twenty-eight volts a.c. was provided for reading lights and, where used, an attendant's call system. A rectifier is located in each car which provides 72 volts for equipment requiring direct current. A constant current full-wave solid-state rectifier charged a 64-volt Ni-cad battery, rated at 120 ampere hours, which provided power for the emergency lights, the intercom system, and the end doors in the event the main power source was lost.

The emergency power batteries were designed to maintain emergency lights for a minimum of 3 hours, but during actual tests, the emergency lights lasted about 30 hours. The hallways in the cars were equipped with emergency ceiling lights that provided a minimum of 5-footcandles illumination at the floor level on a fully charged battery. Also, a 6-watt light was provided in each bedroom and in each toilet. The stairways and the treads of the steps were also lighted. If the electrical circuit breakers are properly set, emergency lights automatically illuminate when a sensor relay determines that the 120-volt transformer has lost power. When similar loss of voltage is sensed by the battery rectifier, the d.c. lighting load is transferred to the battery.

The interconnecting electrical wiring used throughout and between the cars was covered with either HYPLALON (basic wiring), POLYOLEFIN, or EXANE (used in the 480-volt circuits). Some multiconductor cables were covered with EXANE. Wires connected to the electrical heaters were covered with TEFZEL and RALOR. In addition, some cabling was sheathed in Polyvinylchloride (PVC) and neoprene. All wiring was protected mechanically by either being run in conduit or wiring ducts. Further the high-voltage circuits were routed underneath the floor and outside the car.

The Communication System.--Each sleeping car was equipped with communication facilities, which included provisions to communicate within the car, throughout the train, with the locomotive engineer, and privately with a person having similar facilities in another car or within the same car. A communication control panel was mounted in the

lower level vestibule area. The system's speakers were mounted at intervals in the hallway ceiling of each car; passengers had no control over the volume.

Each bedroom was equipped with a passenger service unit -- a separate intercom system equipped with a speaker and volume control primarily for entertainment. However, channel No. 1 of the system was connected to the train's intercom system. Announcements over the train's system could have been heard in each bedroom if the channel selector switch had been positioned at channel No. 1 and if the volume control on the passenger service unit in the individual bedrooms had not been turned to mute the output of the speaker. Passengers were not instructed in the use of either intercom system.

Each bedroom also was equipped with an attendant call button which, when activated, caused a light to illuminate outside the bedroom door and a chime to sound throughout the car over selected speakers of the car's intercom system. The annunciator panel was located in the lower vestibule near bedroom No. 14, which normally was occupied by the car attendant.

Ventilation System.--An air conditioning unit capable of moving 3,000 cubic feet/minute (cfm) of air was located at each end of each sleeper car. About 1,700 cfm of fresh air circulated into the car from the outside through filtered openings in the ends of the car and mixed with inside air which was being recirculated. The recirculated air was picked up through grills at each end of the car on the upper level and through ceiling panels on the lower level. Air was exhausted through ceiling vents from the restrooms and was vented to the outside at the "A" ends of the car. (See figure 3.)

Climatized air was provided to each bedroom through a ceiling vent. The room temperature could be controlled by the occupant's adjusting the diffuser over the vent and controlling the flow of air into the bedroom. Heat from the central system could be supplemented by an electric heater within the bedroom.

Car Arrangement.--The superliner sleeping car consisted of economy (see figure 9) and deluxe bedrooms. The economy bedrooms were identified numerically and the deluxe bedrooms were identified alphabetically. (See figure 2.) Thirty passengers could be accommodated on the upper level of the car. A handicapped bedroom, equipped with appropriate facilities, a family bedroom, and four economy bedrooms were located on the lower level, which could accommodate 14 passengers. Five unisex restrooms for the economy bedroom passengers were also located on the lower level. The entrance to each bedroom was provided with a full-length curtain and a sliding door which contained a glass window and a door lock. The bedroom door could be locked only from the inside. To open a locked bedroom door from the outside, a phillips-type screwdriver must be used to remove screws holding a coverplate over the lock, and then a standard coach key can be inserted to unlock the door.

In the original design, emergency window exits were provided on the upper level in bedrooms Nos. 3 and 8, bedroom B, and in the hallway opposite bedroom D. Emergency windows on the lower level were located in bedrooms Nos. 12 and 13. These locations may have been changed in the course of repair work to the windows while the cars were in service. The removable emergency window consisted of a double-glazed unit comprised of an outside pane of 1/4-inch safety glass and an inside pane of 1/4-inch

Lexan, <sup>4/</sup> separated by a 1/4-inch air space. The emergency windows were identified by a red handle labeled "Emergency Exit - Pull Handle, Remove Rubber" located at the top of the glass.

To remove the window of an emergency exit, the red handle must be pulled inward to start the separation of the glass from the rubber moulding around the glass. After the moulding has been removed, a small handle affixed to the glass is exposed. Grasping and exerting a steady pull on the handle allows the glass to be pulled inside the car, thus clearing the window as an emergency exit.

As a result of a recommendation made by Safety Board investigators at the incident site, Amtrak is relocating the window pulls on the emergency window exits from the top to the bottom of the window to provide higher visibility and to eliminate the interference of a lowered upper berth with the operation of the emergency window exits in the economy bedrooms.

The one-piece, hinged vestibule doors opened inward. Each door was provided with a glass window that could be opened without opening the door. The doors could be locked with a standard coach key. When the doors are properly closed, a safety latch located at the top corner of the door had to be released before the vestibule door could be opened. Under normal conditions, the doors at each end of the upper level opened automatically for about 15 seconds when either a middoor level push plate or a lower kickplate was pushed from either side of the door. A feather edge switch panel, sensitive to touch or an obstruction in the doorway, would cause the door to reopen. A toggle switch mounted near the top of the door on the wall structure could be positioned so that the door could be held open permanently. If the 72-volt d.c. control voltage was lost, an air-operated mechanism would automatically open the door. If both the control voltage and the air were lost, the door mechanism would become inert and would require manual operation to the open or closed position.

Interior Trim and Furnishings.--The economy bedrooms were equipped with two adjustable seats. The lower berth was formed by placing the seat and seatback cushions in a horizontal position and then covering them with a neoprene mattress. A separate headrest was attached to the wall partition behind each seat.

The upper berth, which was hinged from the outside wall of the car, was lowered manually. It was equipped with a mattress, safety straps, and a grab handle, as well as reading lights, a heating control, and emergency light.

The partitions between the bedrooms and between the bedrooms and the hallways were constructed of plymetal panels, <sup>5/</sup> which were covered by either melamine plastic, fiberglass reinforced plastic, or carpet. The flooring of the upper and lower levels also was constructed of either 5/8-inch or 3/4-inch plymetal panels.

The deluxe bedrooms were constructed similarly to the economy-class bedrooms, except for a two-sectional transverse seat located against the cross partition which formed the lower berth. A hinged upper berth was positioned above the lower berth area.

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<sup>4/</sup> A clear, tough, puncture-resistant polycarbonate plastic sheet used as unbreakable glass.

<sup>5/</sup> Plywood covered on each side with 0.015-inch stainless steel or 0.015-inch aluminum. (Also see appendix D.)



Figure 9.--Interior view of undamaged economy type bedroom.

The interior walls of the bedrooms, the ceilings, the floors, and the undersides of the upper berth were covered with Amtrak-approved nylon carpet. A neoprene backing pad was bonded to the carpet. Wool-nylon curtains or draperies were installed over the windows and doors. Melamine covered the partition between the bedroom and the hallways. (See appendix D.)

The hallway floors, the outside walls, and the bedroom walls also were carpeted. The ceiling was carpeted, except in the middle of the car where a strip of melamine-covered ducting was exposed. Additionally, carpeting and plymetal was used in the vestibule area. A water base latex carpet adhesive was used.

The seat armrests and passenger service units contained selfskinning, polyurethane. Tests conducted by the National Bureau of Standards (NBS) show that fire can spread from integral skin urethane foam seat assemblies to adjacent seats even if there is a very small ignition source.<sup>6/</sup> According to an Amtrak official, however, because of the lack of approved testing techniques, a standard for toxicity, and technology to provide suitable or better substitutes for the polyurethane, a waiver was issued that allowed polyurethane to be used in the chair armrests and the passenger service units. The seat cushions originally installed were constructed of neoprene and upholstered with wool/nylon material.

<sup>6/</sup> WMATA "A Fire Hazard Evaluation of the Interior of WMATA Metro Rail Cars," NBSIR-75-971.



However, the cushions were being replaced with improved materials during scheduled maintenance of the cars in the fleet. The polyurethane originally used in the 1130 car had not been replaced. The mattresses were made of neoprene and cotton ticking. (See appendix D.) An ashtray with a removable core and a hinged cover was built into the armrest on the outside wall.

Guidelines suggested by the Association of American Railroads for passenger car safety standards and features were used in the design and construction of the car. The fabric, carpets, and items used in the interior trim were specified and supplied by Amtrak. The Pullman Company was not required to perform flammability tests or any other tests to prove their acceptability. The seats used in the cars were supplied by Amtrak as a unit and installed by the builder. The mattresses, bed linens, towels, pillows, and blankets also were supplied by Amtrak. The bed linens, towels, and pillows are flammable and could be a fire hazard if they came in contact with burning cigarettes or the electric base board heating. The specification for these items may have changed over the years as a result of competitive bids for supply contracts. The Pullman Company built the outer container or shell to support the mattress for the upper berth.

The fire-retardant materials specified by Amtrak to be used in the interior of the superliner cars in 1974, when the 1130 car was built, were the best available and were state-of-the-art. Acrylic carpet materials were used on vertical and overhead surfaces because if heat caused the materials to ignite and burn, and thus melt, acrylic materials do not flow or drip. Plymetal panels were used extensively in partitions and flooring because plymetal was the best fire-retardant material available at that time. Amtrak used New York Port Authority guidelines, which derived from work by the Urban Mass Transportation Administration (UMTA) in cooperation with the Transportation Systems Center (TSC) at Cambridge, Massachusetts, to specify materials with a high degree of fire retardancy and low toxicity.

The interior linings and partitions of the cars were required by Amtrak to meet the fire retardancy tests of Federal Aviation Regulations (FAR) 14 CFR 25.853(a). The seat and floor coverings were required to meet the fire retardancy requirements and other provisions of Amtrak seat specifications. (See appendix E, sections 1.1, 1.2, and 1.3.) In addition, at the time of installation, floor coverings and pads were required by Amtrak to meet the then existing requirements of the New York Port Authority (see appendix E, section 1.4).

All materials used, except metals, were subjected to tests conducted in the presence of Amtrak representatives, to determine burn rate and smoke emission qualities. As an alternative, suppliers were allowed to submit a certificate of satisfactory testing performed by an approved independent laboratory. The contractor was required by Amtrak to use materials in the construction of the interior trim and furnishings which had been accepted as safe from a toxicity standpoint by the NBS.

While the superliner cars were under design and construction, specifications for materials were continually upgraded as better materials appeared on the market. For example, polyurethane chair armrests had been specified originally in the superliner cars because no suitable synthetic material was available that would provide the moulding and cushioning qualities needed even though polyurethane emits highly toxic hydrogen cyanide gas when it burns. However, since 1974, selfskinning neoprenes, which provide better fire resistant qualities and protection and which meet Amtrak's flammability standards have become available. Amtrak is phasing out the polyurethane armrests and replacing them

through attrition with selfskinning neoprene armrests. Other materials used in the car's interior also are being continually changed and upgraded. Amtrak is working closely with UMTA, the NBS, the General Electric Company, The Budd Company, and rail rapid transit companies to improve materials for increased safety.

Emergency Equipment.--Each sleeping car was provided with two dry chemical fire extinguishers: a 10-pound capacity unit on the upper level near the stairway and a 15-pound capacity unit on the lower level in the vestibule. A 6-pound sledge hammer, a pinch bar, and a first-aid kit were contained in a recessed glass-covered cabinet which was located in the lower level vestibule area.

Insulation.--Fiberglass insulation was used in the floors, sidewalls, end walls, and air ducts of the sleeping cars. The amount of insulation varied in density and thickness to provide the degree of insulation required. Fire retardancy requirements met or exceeded 14 CFR 15.853(b). (See appendix D.)

### Method of Operation

In the area of the accident, trains are operated on the single-track mainline over the Valley Sub-Division, a part of the Sacramento Division of the SP, by train orders, timetable, and signal aspects of a Centralized Traffic Control (CTC) system which is controlled by the train dispatcher at Roseville, California. Timetable direction for train movement is east toward Portland and west toward Oakland, which in fact are geographically north and south, respectively. Train No. 11 was a westbound train by timetable direction but it geographically was moving south. The maximum authorized speed for passenger trains through the vicinity of Gibson is 25 mph because of track curvature. The maximum authorized speed for the Sacramento Division is 70 mph.

SP rules charge the conductor and the engineer with joint responsibility for the safe operation of the train. The conductor is the recognized onboard operating supervisor to whom the operating crewmembers and Amtrak service personnel report directly.

The conductor receives and sells tickets, can assign spaces in sleeping cars or coaches, and in general, directs the activities of the Amtrak service personnel. The SP operates Amtrak trains over its tracks pursuant to an agreement between the two organizations.

Passenger manifest lists containing the names, spaces assigned to passengers, and the passenger's boarding and detraining points are provided to the car attendants. A car attendant cannot reassign passengers to different spaces without the approval of the conductor. Handicapped persons must reserve the handicapped bedroom in advance; otherwise, the bedroom may be assigned to anyone.

### Meteorological Information

On the morning of June 23, 1982, the weather for the Gibson area was clear with a light breeze blowing from the northeast. The temperature was about 60° F.

### Firefighting

About 1:55 a.m., the CVFD was notified about the fire on train No. 11. About 2:15 a.m., CVFD firefighters with four emergency firefighting units arrived at the accident scene. Shortly afterward, firefighting personnel from the California Department

of Forestry (CDF), the Shasta Lake Volunteer Fire Department (SLVFD), the Dunsmuir Fire Department (DFD), and the Mountaingate Volunteer Fire Department (MVFD), and firefighting and medical personnel from the Lake Shore Volunteer Fire Department (LSVFD) arrived at the scene. A deputy sheriff from the Shasta County, California, Sheriff's Office was also at the scene. Emergency personnel provided oxygen to the handicapped passenger, but he died at the scene.

When the CVFD arrived at the scene, flames were coming out of both ends of the car and through broken windows. Firefighters immediately setup their equipment and emergency lights for illumination. Shortly thereafter, when the LSVFD fire chief arrived at the scene and saw that the CVFD had its equipment positioned and ready to fight the fire, he declined to take over or interfere but began arranging transportation to move the passengers from Gibson.

About 5 to 7 minutes after the firefighters had begun to apply water to the burning car, the fire and heat had been reduced and the CVFD firefighters, wearing backpacks containing breathing apparatus, entered the 1130 car from both ends. The CVFD chief reported that the firefighters encountered difficulty moving within the car because the hallways were too narrow and too low to accommodate a large person with an airpack strapped to his back. Fallen partitions and doors restricted and hampered their movements and the metal construction material made it difficult for the firemen to remove doors or partitions to provide better routes to move through the car. The CVFD chief said that he was unable to gain access to the upper level through the vestibule because of the debris which had fallen into the stairwell.

The CVFD chief said that he was baffled by the limited access routes to the upper level. He believed that an access route to the upper level, other than through the vestibule stairway, should have been available. Following a postincident critique of the performance of the CVFD at Gibson, the SP arranged for the CVFD and the DFD firefighters to tour some superliner equipment following a request by the CVFD chief. The CVFD chief described the tour as being very helpful. He said that the only training the department had received on fire on railroad equipment was instruction on how to handle dome cars (tank cars) and propane tanks.

The CVFD chief had been informed by one of the operating personnel that the four rear cars were to be moved to the side track so that the main track could be cleared. At that time, the LSVFD chief told the CVFD chief that if he wished to do so he and his men could leave and that the LSVFD would do the final cleanup which consisted of searching for "hot spots" or smoldering debris.

### Other Investigations

In addition to the investigation by the Safety Board, the fire on train No. 11 was investigated by the Federal Railroad Administration (FRA), the State of California Fire Marshal's Office, the Shasta County Fire Department, and separate private investigators for Amtrak, and the Pullman Standard Company. The purpose of the investigation by the State Fire Marshal's Office was to determine if a crime (arson) had been committed, i.e., had the fire been deliberately started. The conclusions reached by the State Fire Marshal's Office and the investigator for Amtrak concur with the findings of Safety Board investigators. (See appendix F.) Copies of reports from other investigators were not provided to the Safety Board, but it was understood verbally that there were no differences in findings.

The Shasta County Fire Department's investigators collected several cigarette butts from the ashtrays in bedroom E which had been occupied by the Regional Director-Passenger Services after about 10:30 p.m on June 23. The State investigator also found a few cigarette butts in the ashtrays of bedroom No. 1, but because of the small number and because of water damage, the butts could not be used to determine if they were the cause of the fire.

Initially, the investigator from the State Fire Marshal's Office concluded that the fire had originated in bedroom E on the upper level of the 1130 car, based on information he had received from the Shasta County Fire Department. However, as he uncovered more evidence, he concluded that the fire originated in bedroom No. 1 on the upper level of the 1130 car. The investigator could not find any traces of a combustible vapor which could have started the fire when he searched through the car with a combustible vapor detector.

### **Medical and Pathological Information**

Smoke inhalation was the primary cause of death and injuries to passengers, SP crewmembers, and Amtrak service personnel. The coroner of Shasta County, California, determined that the handicapped passenger in bedroom A of the 1131 car died of cardiorespiratory failure due to soot and smoke inhalation. The coroner determined that the passenger in bedroom No. 6 of the 1130 car died of possible carbon monoxide poisoning; an autopsy of the passenger revealed a carbon monoxide level of 36 percent saturation. Carbon monoxide levels over 20 percent saturation are potentially toxic.

The cyanide level in the blood of the passenger in bedroom No. 6 was 0.2 mg/ml <sup>7/</sup> of blood. The toxic threshold for cyanide is 0.7 mg/ml blood by ingestion. Inhalation of hydrogen cyanide results in signs and symptoms of acute toxicity at 0.2 mg/ml. Cyanide was not detected in the blood of the passenger in bedroom A. Blood samples taken from 26 persons who had been on the train and analyzed for carbon monoxide revealed levels that ranged from 1 to 17.8 percent. The highest level was found in a couple who were passengers in the 1130 car.

### **Survival Aspects**

When passengers from each of the sleeping cars were questioned, they gave varied reports about how they were awakened and how they became aware of the fire. Some passengers said that they were awake when the 1130 car attendant called the conductor over the intercom system. Other passengers said that they were awakened by the intercom announcement, by smoke, or by a knock on their bedroom doors. Passengers who said that the air vent in their bedrooms was closed reported that very little smoke was in their room until the compartment door was opened. In all instances, the smoke was reported to be increasingly dense from the ceiling toward the floor.

Train personnel said it was difficult to check on passengers after the evacuation because they were scattered everywhere -- some going into the cafe/lounge car and coaches and some standing outside the cars. Passengers reported exiting from various locations. Some passengers in the 1131 car proceeded toward the 1130 car but were turned back by the smoke and had to exit through the vestibule of the 1131 car. Passengers in the 1130 car exited through the 1131 car, the vestibule of the 1130 car, or

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<sup>7/</sup> Micrograms per milliliter - also, Source I. Sunhsine and B. Finkle, "The Necessity for Tissue Studies in Fatal Cyanide Poisoning."

proceeded forward into the dining car. Several passengers recalled operating the end doors to proceed into the adjacent car.

Some passengers reported crawling on the hallway floor because a small clear space was available just above the floor. Other passengers used the handrails and walls to guide them as they moved through the smoke. Passengers reported that, although the car lights were still on, the ceiling lights did not penetrate the smoke to light the floor sufficiently and that they were moving in almost total darkness. In some instances, passengers bumped into other persons who led them to safety. Several passengers, Amtrak service personnel, and SP crewmen entered or attempted to enter the smoke-filled cars to lead people out. Others stationed themselves in the vestibule area and pulled passengers to safety through the vestibule doors.

A few passengers reported attempting to escape from their bedrooms via the emergency windows. However, they were unable to displace the window because the moulding could not be removed. One Amtrak service person successfully removed the emergency window in a lower level bedroom in the 1130 car and escaped through the opening. Some passengers attempted to break the windows with bunk ladders, but the Lexan pane could not be broken. A passenger in bedroom No. 10 of the 1130 car said that it took 10 to 15 minutes to open the bedroom door, which she had reported as being difficult to open the day before the incident. According to the passenger, the trainman who had assisted her in the first instance commented that the bedroom doors frequently were difficult to open. Some passengers could not open the vestibule door in the 1130 car because they were not aware that a safety latch at the top of the door had to be released first. There were also reports that the vestibule doors of other cars were key-locked and that the passengers could not open them.

Rescuers attempted to remove windows from outside the cars, especially in bedroom A of the 1131 car, but they could not remove or break the windows using an axe or a sledge hammer. One window was finally opened after the rubber moulding was cut sufficiently so it could be pulled out.

Passengers who had occupied space in the two sleeping cars, the two sleeping car attendants, and the rear brakeman were transported in two schoolbuses to the Redding Hospital Center, which had been notified of the incident about 3:30 a.m. Off-duty medical personnel were called in and a triage 8/ area was set up for the persons who began arriving at the hospital between 6:30 and 7:10 a.m. From the triage area, persons were sent to the emergency room where they were treated and released, admitted, or sent to a temporary intermediate clinic which had been set up in the hospital.

### **Other Information**

Amtrak's Training Program.--Newly hired Amtrak onboard service employees are required to attend a 14-day training program (7 days in a classroom and 7 days on student trips). The training program includes general rules concerning passenger surveillance to be alert to their comfort and needs, housekeeping in the car, smoking and drinking while on duty, and safety; sanitation procedures; safe work habits; courteous conduct; handling of handicapped passengers; and emergency procedures. The classes are taught by employee organizational development specialists, trainers in the field, and training

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8/ A receiving area established by emergency doctors and medical technicians to classify treatment of the injured on a priority basis.

resource employees. Trainers are selected professionals in their area of expertise. The training objectives are a basic orientation to the equipment and learning to work onboard the train.

The emergency procedures training basically is a review of the material contained in Amtrak Service Manual A, "General Rules for Service Employees Working Onboard," which states that "onboard employees will insure the proper handling of the passenger's needs." Under general derailment and catastrophic procedures, the manual states that "Amtrak service employees... are looked upon for leadership in unforeseen and emergency situations. Employees must remain calm and keep the passengers calm and informed. Qualified employees should render first aid. If it is necessary to evacuate the cars, employees should check the area for down (fallen) power lines, traffic, footing, etc."

The classroom training includes fire safety and the location and operation of emergency and fire equipment. Amtrak officials stated that although the equipment is pointed out to students during training trips, no "hands on" operation of the equipment is used to reenforce the procedures classroom training. Onsite training on all Amtrak equipment includes the location and operation of the fire extinguishers and emergency tools, first aid kits, emergency exits, emergency doors, and pencil locks. <sup>9/</sup> At this time, car attendants are also not provided with nor trained in the use of any type of breathing apparatus.

Training centers are located in Boston, Massachusetts; New York, New York; Miami, Florida; Chicago, Illinois; Oakland, California; and Los Angeles, California. Also, training programs are offered at Washington, D.C.; Jacksonville, Florida; New Orleans, Louisiana; Seattle, Washington; Minneapolis, Minnesota; and St. Louis, Missouri. Because superliner equipment is not used on the east coast, the training centers on the east coast only describe superliner equipment and concentrate on the equipment on which the students will be working.

Students are tested at the end of the program and they must receive a 70 percent grade to pass. If a student fails an element of the test, the element must be reviewed and the student does not advance in training until the student passes the element satisfactorily.

Refresher training courses are instituted generally when the training group is told by a vice president or regional director that emphasis on a specific part of the service is needed. Training courses are coordinated with the Manager of Safety. For some unknown reason, an 8-hour multimedia Red Cross first-aid course for employees was eliminated from the training program several years ago, but it is being reinstated in a modified version. Simulation of evacuation procedures has not been used in training sessions.

During training before the Gibson accident, car attendants were instructed to check with the conductor in the event of unusual occurrences on their cars. Also, they were instructed to switch off the ventilation system fans (HVAC) immediately in the event of a fire. However, since the accident, new training films have been developed which direct attendants to notify a crewmember, turn off the ventilation fans, investigate for the location of the fire, determine if evacuation of passengers is desirable, and determine if a fire is controllable. They are instructed that in the event evacuation is necessary to try first to use the end doors into an adjacent car, the vestibule doors next, the emergency exit windows on the lower level next, and if left with no other alternative, to use the

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<sup>9/</sup> Locks that can be operated by the insertion of a slender rod, such as a pencil.

emergency windows on the upper level. The films instruct the car attendants to store trash in designated containers which are off-loaded at designated points and to store soiled linens in a locker until they can be off-loaded. Although there is no policy on the position of the vacant bedroom doors, they generally are left open.

Passenger Information.--A passenger information handout is being provided for use by car attendants on superliner equipment, and Amtrak plans to distribute it to passengers in the future. (See appendix G.) Also, Amtrak plans to permanently mount diagrams of the superliner car arrangement with the exits and emergency escape windows conspicuously marked in prominent places throughout the car. Part of the car attendant's routine duty will be to brief passengers on the arrangement of their accommodations and to call their attention to the card and its subject matter.

SP Crewmen Emergency Training Procedures.--The SP train crewmembers testified that they had not received training in emergency evacuation procedures of passengers under circumstances of a fire or a derailment, and that the SP safety rules did not include emergency evacuation procedures.

## **ANALYSIS**

### **Fire Origin**

Reconstruction of the events preceding the fire and establishing the origin of the fire were difficult. Firefighters moved some of the partitions, furniture, and luggage within the area of the fire; pulled down sections of the ceiling; and, in general, disturbed the interior of the 1130 car in their attack to extinguish the fire and eliminate "hot spots." Also, several investigators who searched through and moved the debris may have further destroyed the integrity of the scene. However, no evidence of combustible vapors was found or any other evidence that would have supported arson as the reason for the fire.

The destruction was most severe in bedroom E on the upper level of the 1130 car. The severe damage at the head of the berths in bedroom E was suggestive of what an investigator would expect to find in an area where a fire started. Also, one witness stated that he saw a red glow in the floor area of bedroom E when he passed that point during the evacuation of the car. Since the Regional Director-Passenger Services and his wife had their luggage, which included a cosmetic case, under the lower bunk, it is possible that a can of aerosol spray may have ignited and provided the "jet of gas flame" described by the Amtrak Road Foreman of Engines-Diesel Supervisor. However, no evidence was found in bedroom E that would support the fire's origin at that location. The testimony of the Regional Director-Passenger Services who stated that there was no smoke or heat when he left bedroom E between 1:40 and 1:45 a.m. and the fact that the fire in bedroom No. 1 had been discovered by the 1130-car attendant by that time suggests bedroom E was not the point of origin of the fire.

The preponderance of the evidence obtained from the investigation and the witness statements leads the Safety Board to believe that the fire originated in bedroom No. 1 of the 1130 car. The burn pattern along the north end of bedroom No. 1 was consistent with its being the origin of a fire. This theory is further supported by the fact that the floor covering of bedroom No. 1 was not completely consumed by the fire and by reports that the flames were first noticed about midway from the floor to the ceiling. The burn damage appeared to progress from the north side of bedroom No. 1, up the wall to the ceiling, across the ceiling, and into bedroom E, where it burned in a pattern that indicates

the fire moved toward the floor. Also, the burn pattern indicated that the fire spread from the center of the car, around the vestibule area, and toward both ends of the car.

Fresh oxygen-laden air would have been supplied from the open vestibule doors and windows, the open end doors, and the upper level windows when the glass began to fall from their encasements. The fresh supply of oxygen would have provided an environment for the fire to have intensified and spread.

Fire from a chemical, an electrical, or a foreign source apparently smoldered for some time before enough heat was generated for flammable toxic gases to be ignited. The most likely point of origin was in the area between the seat cushion and the seatback. Based on the evidence and the data gathered during the investigation, the Safety Board believes the most likely cause of the fire was a discarded or misplaced cigarette. Experience gained from fire testing materials has shown that some materials that have been treated for fire retardancy can burn with an intensely hot flame once they are ignited. The trim materials used inside the car had been treated for fire retardancy. This could account for the high temperatures that were encountered and were evident in the damage to the structural elements of the car after the fire. The sheets and pillowcases used on the superliner cars probably would ignite quite readily and support combustion if a source of heat or flame were present. The origin of the fire at this level in the bedroom is further supported by the burn pattern on the floor and by witnesses statements that the fire was first sighted some distance above the floor. All witnesses who viewed the 1130 car early in the accident sequence said the glow or flames were near the center of the car and on the east side of the car. Bedroom No. 1 was situated on the east side of the car. Additionally, the progress of the fire was from the center toward each end of the car. Apparently, the plymetal flooring and insulation prevented the flame from spreading to the lower level before the fire was brought under control. The engine crew could not have seen a glow in a car back in the train on the west side because their view was across a left-hand curve.

When the 1130 car attendant first observed the smoke and flames in bedroom No. 1, it is likely that the heat had reached such a level that volatile gases were being emitted. As the supply of oxygen varied, the gases likely ignited and burned intermittently. If the attendant had closed the bedroom door or used the fire extinguisher at that time, the fire probably would have been contained or extinguished. Further, if she had shut off the HVAC system fans, the movement of the smoke would not have been accelerated. The continued operation of the ventilating system fans in the adjacent cars drew in the smoke and fumes from the burning car and, thus, compounded the difficult situation by involving cars other than that which was afire. The 1130 car attendant followed, in part, the instructions given her during her training by calling for the assistance of the conductor. However, when she opened the windows in the vestibule doors to let out the smoke, the in-flowing fresh air provided an additional oxygen supply to the smoldering fire and allowed it to flare up. The conflicting reports of passengers who saw flames and those who did not can be reconciled on the basis of the fluctuating availability of oxygen to nurture the flame. When the supply was plentiful, the flame erupted; when the supply decreased or was used up, the flame died down. In addition, the smoke was an impairment to observing the flame because of its density and its irritating effect on the eyes.

Bedroom No. 1 was vacated about 10:15 p.m. when train No. 11 stopped at Klamath Falls. Based upon the train's departure from Dunsmuir at 12:50 a.m., the 1130 car attendant probably passed the room about 1 a.m. At that time, she did not observe anything unusual in the vicinity of bedroom No. 1. She stated that about 1:30 a.m., she was at the top of the stairs and passing bedroom No. 1 when she saw smoke and flames.



Since the flames were already evident at 1:30 a.m., the smoldering period would have ended before 1:30 a.m. The total elapsed time after the bedroom was last used could have been as much as 3 1/2 hours. Experience gained by experts in dealing with fires of this nature has shown that a fire can smolder in material that will support combustion for well over 2 hours before erupting into flames. Circumstances can vary this time considerably. Even if the material will not support combustion, if it is burned through, underlying combustible material can ignite, smolder, and cause a heat buildup. If this occurs, the heat probably would generate combustible toxic gases which would ignite when the proper combination of heat, oxygen, and draft was reached.

The apparent above-the-floor beginning point of the burn pattern in bedroom No. 1 supports a theory of a nonelectrical origin of the fire. In most cases where a short circuit occurs, a circuit breaker will operate and "kill" the circuit. All electrical circuits were protected by circuit breakers. Also, the electrical wires were sheathed in flame-resistant covering and the wires were laid in protective metal ducts. The exposed wires did not have the carbonizing burns or beading usually present when an electrical wire is short circuited and separates because of the internal heat generated by the current flow.

### **Combustible Construction Materials**

According to Amtrak, the materials used for the interior trim of the sleeping cars when they were built in 1974 were the best products available at the time for fire retardancy and flammability. The waiver given to the supplier by Amtrak to allow the use of selfskinning urethane (foam polyurethane) in the chair armrests and the passenger service units because of a lack of other suitable materials seemingly has created a potentially dangerous situation and one that is recognized among rail car builders for both railroads and rail rapid transit companies as needing correction. Although polyurethane is flame-resistant, it will melt and emit toxic gases if heated as by a smoldering fire. The toxicity of the gas cannot be measured. Since very few cigarette butts were found in the ashtrays of bedroom No. 1, since only one armrest -- which had no built-in ashtray -- was burned severely, and since the burn pattern of the armrest appears to have been caused by a heat source external to the armrests, it is unlikely that a fire originated in the armrests as a result of cigarettes in the ashtrays. Further, since polyurethane tends to stop burning when the flame is removed, there is no evidence to support the theory that the fire originated in the armrests of the chairs or that the polyurethane was instrumental in causing or spreading the fire in the 1130 car.

The neoprene carpet backing and the seat coverings were highly resistant to burning. The most highly flammable materials used in the bedrooms were the bedding and accessories associated with the berths. If a heat source had penetrated into the mattress ticking or bedding, a fire could have resulted.

Although the Regional Director-Passenger Services did not take exception to the "house cleaning" on train No. 11, investigators found paper trash containers filled with styrofoam cups and numerous cigarette butts. There is no evidence to suggest that the fire in the 1130 car originated in the trash container. However, because trash containers are used as receptacles for the contents of ashtrays, thereby posing a fire hazard, Amtrak should provide nonflammable trash containers.

On November 26, 1982, UMTA published a Notice and Request for Public Comment (NRPC) on "Recommended Fire Safety Practices for Rail Transit Materials Selection," Docket No. 92-C, Volume 47, Federal Register 53559. This document proposes standards for testing the flammability and smoke emission characteristics of materials used in the

construction of rapid rail transit and light rail transit vehicles. These proposed standards were, in part, a response to Safety Board recommendation R-79-54 issued to UMTA after the train fire on the Bay Area Rapid Transit District on January 17, 1979, 10/ and safety recommendations R-81-6 and -13 issued to UMTA on January 22, 1981, after the Safety Board's public hearing on rapid rail transit. 11/ After reviewing the NRPC, the Safety Board indicated to UMTA that it generally supported the guidelines. (See appendix H.) The cooperative effort indicated by rail rapid transit companies, manufacturers of equipment, Amtrak, and the Department of Transportation is commendable and this effort should result in improved materials for use in passenger car construction and trim.

The Safety Board believes that the proposed standards are a move in the right direction to reduce fire hazards in rail passenger vehicles. The FRA was tasked by the Congress to develop passenger car safety standards which should also address the flammability characteristics, smoke emission, and toxicity of materials. The Safety Board believes that, once the standards are adopted, the FRA should include the guidelines as part of the passenger car safety standards as a requirement to be followed by manufacturers of future-generation rail passenger cars.

### Evacuation

The evacuation of passengers from the two sleeping cars was haphazard. There was no prescribed plan, and no one person directed the evacuation. Since the conductor was the recognized highest authority on the train, he should have organized the evacuation and directed the activities associated with identifying the passengers and arranging for their safety and comfort. He could have delegated the separation of the train, to which he gave inordinate attention, to a subordinate crewmember. The conductor did not give an account of his activities after the separation of the train was completed. He did not say who directed the movement of the train when the rear four cars were switched to the siding. With few exceptions, the passengers were left to themselves to evacuate the cars. In the early stages of the evacuation, more effort was made to identify which passengers had detrained, rather than to attempt to determine if passengers were still inside the cars. When the head brakeman realized that some of the bedroom doors were still closed when he first entered car 1130, he should have attempted to alert or remove the passengers. Apparently, no one attempted to attract the attention of passengers still inside the cars by at least throwing rocks at the windows or by making other attention-getting noises. Many people tried to facilitate the removal of the passengers, but their efforts were not organized. For example, while the 1131 car attendant was preoccupied with the minor task of helping people at the vestibule, she should have been assisting the handicapped passenger who was still in bedroom A.

Many other things could be said in retrospect about what actions should have or could have been taken. Recognizing that almost without exception, those persons engaged in rescue operations were exposed to heavy, acrid, toxic smoke and may not have been thinking clearly, the Safety Board believes that the service personnel, particularly, and the operating train crew did not conduct an effective initial response to the emergency. The Safety Board attributes this almost exclusively to inadequate training. Without proper training, most people instinctively are concerned with self-preservation or can

10/ Railroad Accident Report--"Bay Area Rapid Transit District Fire on Train No. 117 and Evacuation of Passengers While in the Transbay Tube, San Francisco, California, January 17, 1979" (NTSB-RAR-79-5).

11/ Safety Effectiveness Evaluation of Rail Rapid Transit Safety (NTSB-SEE-81-1).

become absorbed in a minor task which they believe is an important contribution to the effort rather than in some essential effort. With training that person instinctively might react effectively.

The Amtrak supervisors onboard train No. 11 should have assumed a more visible role of leadership during the emergency. The Amtrak service personnel and the SP crewmen may have expected such action and may have waited for directions from the supervisors, even though the conductor normally should have provided this guidance.

Beyond the heroic action of the passenger in bedroom No. 7 of car 1131 and despite their slow recognition and discharge of their duties, the 1130 car attendant, the rear brakeman, and other persons who assisted in the rescue of passengers and who attempted to enter the sleepers acted courageously. While the Amtrak supervisors did not perform as might have been expected of supervisors, they did take individual risks during the emergency, and their efforts should also be recognized as courageous.

### Training

The SP crewmen, the Amtrak service personnel, and the supervisors probably did not attempt to use a fire extinguisher to spray around the upper level vestibule area because they had been inadequately trained for such emergencies. If the SP and Amtrak onboard personnel had been trained in the evacuation of passengers under conditions of fire, derailment, or flood, their responses probably would have been more effective and the outcome of the incident probably would have been different. Adequate training prepares trainees for specific tasks during an emergency, rather than allowing them to get caught up in random or uncoordinated efforts which may or may not contribute effectively to the rescue effort. In the event of an emergency, they will usually revert subconsciously to the proper emergency procedures if they have been taught effectively. This was evidenced by the 1130 car attendant's statement after the incident that the actions she took were in accordance with and the results of her flight attendant training.

The conductor said that he ordered the power to the cars shut off but that after thinking that the fans were needed to exhaust the smoke, he had the power restored. Had he been more knowledgeable of the climatic systems on the sleeping car, which could have been accomplished through training, he would have been better equipped to make such a decision. The best decision would have been to shut off the HVAC system immediately. Only the conductor and the Road Foreman of Engines-Diesel Supervisor gave any indication of a concern for the continued operation of the ventilating fan system. Amtrak Service Manual A, "General Rules for Service Employees working on Board," provides only general emergency procedures for personnel, and it does not assign specific responsibilities to individuals onboard the train. The 1130 car attendant had been told in training that she should cut off the ventilation system fans, but she had had no "hands-on" training exercises to emphasize this action. Also, she had not been instructed on the operation of the fire extinguishers or the emergency window exits. Hands-on training may have impressed the 1130 car attendant and/or other persons to whom a fire extinguisher was available so that under the stressful situation they would have reacted to use the fire extinguishers effectively. The 1131 car attendant also failed to shut off the ventilation system fans in her car, and she did not persist in her effort to arouse the handicapped passenger in bedroom A. "Hands on" training is much more effective in making a lasting impression than lectures or visual aids, and Amtrak should use more of this training technique in its training program. Had the attendants been trained in actually operating a fire extinguisher, in opening an emergency escape window, and in shutting down a ventilating fan system, they might have responded more effectively.

The 1130 car attendant could have announced to the passengers that they were to evacuate their quarters quickly and could have provided them with directions on how to evacuate safely. Simulated training involving fire in a passenger coach or sleeping car would have provided the train personnel with the necessary knowledge to evacuate passengers in an orderly manner from the affected cars. Also, a systematic check of the bedrooms would have eliminated the problem encountered by the car attendants when they attempted to account for all the passengers. A passenger check also should have been accomplished by the SP trainmen and/or the Amtrak service or supervisory personnel.

The operating crew was operating the train in accordance with SP operating rules before the incident. The engineer used good judgment in being prepared to stop and in then stopping the train when he heard the radio conversations about the problem on the 1130 car. His decision to stop at Gibson facilitated rescue operations.

The SP operating crewmembers were not assigned regularly to passenger train service. SP personnel who worked infrequently on Amtrak passenger trains were unfamiliar with the equipment. For example, the locomotive engineer, who was not a regular passenger service employee, had difficulty shutting off, or instructing the fireman in shutting off the 480-volt a.c. HEP. Undoubtedly, this was the result of his lack of familiarity with the equipment. The rear brakeman, who was assigned regularly to freight service, was not experienced in passenger service. Although his response to the emergency situation was exemplary, if he had been more familiar with the arrangement of the equipment, he may have been more effective in notifying and evacuating the passengers. The conductor was not currently assigned to passenger service as a conductor, but he had worked the position before on a regular basis. Most of the SP traincrew personnel were familiar with the old standard passenger equipment used in passenger service by the SP before Amtrak began operating passenger trains, but were not as familiar with the superliner equipment. Amtrak and the operating railroads over whose tracks Amtrak operate should coordinate a training program to insure that railroad operating crewmen who are qualified to operate an Amtrak passenger train are familiar with the passenger car equipment and emergency evacuation procedures.

The sleeping car attendants on train No. 11 were not assigned on a regular basis to service on the sleeping cars. The 1130 car attendant was untrained on the superliner equipment. While the attendant and the other Amtrak personnel were considered qualified for the positions they were working, there were elements of their jobs of which they had vague knowledge. Adequate training and reviews would better equip them to respond in emergency situations.

The Safety Board has stressed the importance of training in other accidents where the evident lack of adequate and coordinated training between the railroad operating crewmembers and Amtrak onboard service personnel was apparent. As a result of its investigation of an accident near Wilmington, Delaware, on October 17, 1975, 12/ the Safety Board recommended that the FRA:

Require carriers to train employees in emergency procedures to be used after an accident, to establish priorities for emergency action, and to conduct accident simulations to test the effectiveness of the program, inviting civic emergency personnel participation. (R-76-29)

12/ Railroad Accident Report--"Collision of Penn Central Transportation Company-Operated Passenger Trains Nos. 132, 944, and 939, near Wilmington, Delaware, October 17, 1975" (NTSB-RAR-76-7).

In response to recommendation R-76-29, the FRA replied on August 22, 1977, that it was "analyzing carrier testing and training programs submitted under [49 CFR] Part 217--Railroad Operation Rules ... and will determine what training and testing regulations are necessary to ensure adequate training programs. ..." The Safety Board is holding the recommendation in an "Open--Acceptable Action" status.

In its investigation of an accident at Seabrook, Maryland, 13/ the Safety Board recommended that the FRA:

Promulgate regulations establishing minimum standards for the training of traincrews in the safe operation of trains and in emergency procedures. (R-79-40)

In response to recommendation R-79-40, the FRA replied on October 15, 1979, that it did not intend to promulgate regulations in the area of training and that it could "best serve the training needs of the industry through research projects" to improve railroad employee training. The Safety Board, however, believes that research alone does not lead to improved action or adoption of standards by the railroad industry and is holding the recommendation in an "Open--Unacceptable Action" status.

Also, as a result of the Seabrook accident, the Safety Board recommended that Amtrak:

Establish a program to train crewmembers in the proper procedures for care of passengers in derailment and emergency situations. (R-79-36)

Amtrak replied on March 21, 1979, that it would "follow up on the training of the crewmembers to deal with derailments and emergency situations" and include such training in its on-going employee training program. The Safety Board is holding recommendation R-79-36 in an "Open--Acceptable Action" status.

Additionally, as a result of its special study of railroad emergency procedures, 14/ the Safety Board recommended on March 5, 1980, that the FRA:

Require operating railroads to develop emergency response plans, put them into effect, and file those plans ... with the FRA. (R-80-7)

The FRA's reply of June 9, 1980, November 14, 1980, and July 14, 1981, indicated that it proposes to develop a model emergency response plan, but that it would rely on the railroad industry and its employees voluntarily implementing such a plan. Recommendation R-80-7 is being held in an "Open--Unacceptable Action" status. The Safety Board urges the FRA to reconsider its position on this important issue. The Safety Board is pursuing an active followup program with the FRA to effectively and expeditiously close out these and other open recommendations.

### Emergency Response

Emergency response units began arriving at Gibson about 25 minutes after they were notified and quickly organized an attack on the fire and brought it under control. The

13/ Railroad Accident Report--"Rear End Collision of Conrail Commuter Train No. 400 and Amtrak Passenger Train No. 60, Seabrook, Maryland, June 9, 1978" (NTSB-RAR-79-3).  
14/ Special Study Report--"Railroad Emergency Procedures," January 18, 1980 (NTSB-RSS-80-1).

chief of the CVFD, which was the first unit at the scene, said that when he arrived he was skeptical of the safety in working around the cars because of the possibility of the presence of high voltage, although the power had been disconnected before the CVFD arrived. He also cited problems caused by the lack of identification of the emergency window exits on the outside of the car, and the difficulty the firemen had in breaking or removing the windows to gain access to the car's interior. Another major difficulty firemen encountered was having to move through the restricted hallways with airpicks strapped to their backs.

The CVFD chief acknowledged that the tour conducted by the SP through the superliner cars after the incident was very enlightening, which would appear to support the Safety Board's position that emergency units along the routes traveled by passenger trains should be made acquainted with the passenger train equipment. The Safety Board addressed this subject in reports that resulted from the investigation of railroad accidents in Pulaski, Tennessee; Elma, Virginia; and Lawrence, Kansas. 15/ The Safety Board still believes, as it stressed in its report of the accident at Lawrence, Kansas, that:

State or Federal agencies should require railroads that operate passenger trains over a territory to provide basic information to fire and rescue agencies along the route. Fire and rescue agencies should be provided information on where to gain access to passenger cars and the location of powerplant and electrical system components, and the location and operation of exits. These training aids should be augmented with periodic walk-through familiarization tours for rescue personnel to reinforce their knowledge of the configurations of different coaches.

As a result of the Seabrook, Maryland, accident, the Safety Board recommended that Amtrak:

Arrange for a program along passenger train routes for training and familiarizing emergency rescue organizations in the type of train equipment being used. (R-79-35)

The Safety Board is encouraged by the publication and distribution of the Emergency Evacuation Procedures, by Amtrak and is holding the recommendation in an "Open--Acceptable Action" status. However, as a result of its investigation of the Gibson incident and other recent accidents, the Safety Board believes that a wider, more systematic and recurrent distribution of the book to local emergency response agencies along Amtrak corridors is in order.

### Emergency Evacuation Preparedness

The bewilderment of the passengers once it became evident that they had to evacuate the cars could have been minimized if Amtrak had conducted at boarding time a brief passenger orientation on the car arrangement and the locations and operation of the emergency window exits and vestibule doors. Since the incident at Gibson, Amtrak has undertaken a training program for its crews designed to assist them in acquainting

15/ Railroad Accident Reports--"Derailment of Amtrak Train on Louisville and Nashville Railroad, Pulaski, Tennessee, October 1, 1975" (NTSB-RAR-76-6) "Derailment of Southern Railway Company Train No. 2, The Crescent, Elma, Virginia, December 3, 1978" (NTSB-RAR-79-4); and "Derailment of Amtrak Train No. 4, The Southwest Limited, on the Atchison, Topeka and Santa Fe Railway Company, Lawrence, Kansas, October 2, 1979" (NTSB-RAR-80-4).

passengers with emergency facilities and evacuation procedures, but more work needs to be done. For example, a diagram of the superliner car, or other car, could be provided in or on the ticket envelope when the passenger purchases a ticket. The car attendants should personally go over the emergency facilities and procedures with passengers of each bedroom.

The potential of a fire and the need for more readily available escape routes were visibly emphasized in this accident. Apparently, the emergency windows in the superliner equipment were designed for escape routes in the event of a derailment and when passengers could move freely about the car. However, in a very short time, the fire had blocked the vestibule escape route from the upper level. Fortunately, the 1130 car was not the last car in the train and the two end doors were usable as escape routes. More emergency windows would have facilitated the successful evacuation of the car. The idea of a fire in a superliner car, or in most rail equipment for that matter, of the magnitude and intensity experienced at Gibson was probably not considered when the equipment was designed, built, and furnished because of the fire resistant materials used in the car's interior and the steel superstructure of the car. The Safety Board believes that the flaws in this engineering concept would have been revealed in a safety evaluation of the car design. No safety feature should be glossed over in a design on the assumption that a particular event cannot happen. Every eventuality conceivable should be anticipated irrespective of its remote chance of occurrence. Design considerations which anticipated fire should have included more emergency escape exits and a fire detection and control system.

Additionally, several other design features should be improved in Amtrak's equipment. In the economy bedrooms with an emergency window, the upper berth in its lowered position covered the window handle from view and interfered with the ready removal of the window glass. The signs identifying the emergency windows were flush mounted on the walls in the hallways and were difficult to see. No provision had been made for passengers to descend to the ground from upper level emergency windows, which were about 12 feet above the top of the rail. The top of the rail can be another 3 to 4 feet higher than firm footing at the base of the rock ballast supporting the track structure. Emergency window exits need to be better marked in passenger cars and more emergency escape exits need to be provided to overcome the possible blocking of access to the emergency windows which may be occasioned by a locked or jammed bedroom door. Passengers related that they were unsuccessful in removing the emergency escape windows because they experienced difficulty in maintaining the necessary secure grasp on the handle affixed to the window glass assembly to remove the assembly. (This problem was corroborated by Safety Board investigators.) Amtrak should study this problem and correct it. Some means should be provided for passengers to safely descend through the windows to the ground from either the upper or lower car level. Better emergency lighting facilities located near the floor are needed to overcome the effects of smoke in the event of a fire. Also, provisions should be incorporated into new cars for an external hook-up to a water supply for a sprinkler system distributed throughout the car, thus, a fire could be more easily controlled. Such an outside hook-up would enable a fire truck's hose to be connected to the sprinkler system and pump water under pressure into the car.

The addition of means of quickly detecting a fire, such as smoke detectors, could guard against recurrence of an accident, such as Gibson. A detection system connected into the ventilation system which when actuated would automatically shut off the fans to the ventilation system would be beneficial. The smoke detecting system could be connected into the central alarm system so everyone could be alerted to a potential danger. Additionally, an alarm system that would sound in each bedroom and that could

be manually or automatically actuated would notify passengers of an emergency in the sleeping cars. Such an alarm system should include an override feature so that the alarm would sound over the intercom speaker in each bedroom, irrespective of whether or not the bedroom occupant had muted the speaker by the volume control or the position of the channel selection switch. Amtrak should explore the feasibility of such a system.

One passenger in the Gibson accident experienced difficulty in opening the bedroom door which delayed her evacuation about 10 minutes. Although excitement may have contributed to the passenger's difficulty, the Safety Board has received other complaints from passengers on other Amtrak trains citing similar problems.<sup>16/</sup> Amtrak should review the hardware associated with the bedroom doors to insure that the doors open freely and easily at all times. Amtrak has reported to Safety Board investigators that the cause of this problem has since been determined and that it is being corrected. Amtrak should perform a system safety analysis of the superliner car to determine the feasibility of incorporating changes to improve safety either in the present fleet of cars or in future generations of passenger cars.

### **Alcohol Use by Railroad Employees**

The Safety Board has long been concerned about the use of alcohol by on-duty railroad employees who are responsible for the safety of a train and/or its passengers. As the result of railroad accidents at Indio, California, and Thousand Palms, California, the Board made several recommendations to the SP concerning alcohol and its related problems.<sup>17/</sup>

After the Thousand Palms accident, which resulted in the death of the alcohol-impaired engineer, injuries to four crewmembers, and damage estimated at \$1.5 million, the SP undertook a program to halt alcohol abuse on its trains. In October 1979, the SP proposed the use of an intoxilyzer.<sup>18/</sup> SP's management believed that the use of the electronic device for the measurement of blood alcohol concentration would reduce prework and on-the-job drinking. In November 1979, the SP management invited Brotherhood of Locomotive Engineers (B of LE) officials to a demonstration of the intoxilyzer and asked for labor's support. As a result of the meeting, SP prepared and mailed to each employee two articles which described the program. In January 1980, SP began familiarizing employees with the program -- information was posted on bulletin boards and voluntary use of the intoxilyzer was started. Although controversial, many employees took no exception to the simple test. However, in February 1980, the B of LE sought an injunction against the use of the intoxilyzer. The injunction was denied in July 1980. The demonstration period of the voluntary use of the intoxilyzer ended in September 1980, when SP began testing all employees as they reported for duty. If the intoxilyzer registered any alcohol use between 0.01 and 0.10 percent, the employee was not permitted to work that day. Even though technically in violation of SP's Rule G, the employee was not penalized except for loss of the day's pay. If the blood alcohol level

<sup>16/</sup> An article written by Jim Faber in the Seattle, Washington, "ENETAI" issued October 22, 1982.

<sup>17/</sup> Railroad Accident Reports--"Rear End Collision of Two Southern Pacific Transportation Company Freight Trains, Indio, California, June 25, 1973" (NTSB-RAR-74-11); and "Rear End Collision of Southern Pacific Transportation Company Freight Trains O2-HOLAT-21 and 01-BSMFK-20, Thousand Palms, California, July 24, 1979" (NTSB-RAR-80-1).

<sup>18/</sup> An electronic device for the measurement of blood alcohol concentration through analysis of a breath sample.



(BAL) indicated 0.10 percent or above, another test would be administered 15 minutes later to verify the first reading and the employee would be removed from service pending an SP investigation or hearing of a Rule G violation.

On September 24, 1980, an employee who had a slight reading on an intoxilyzer was not permitted to work. Two days later, on September 26, 1980, the B of LE called a strike, against the SP. On September 27, 1980, a temporary restraining order, which placed heavy restriction on the intoxilyzer's use, was issued. The restraining order was followed by a permanent injunction. In May 1982, the National Railroad Adjustment Board (NRAB) ordered the SP to rescind the program in its present form based on the SP's unilateral change of past practices -- ignoring the definition of "under the influence" and indiscriminate application.

After SP was prohibited from using the intoxilyzer, on or about July 1, 1982, it instituted a self-certification program on all operating divisions. (see appendix I). The self-certification program requires that employees having supervisory responsibility certify, in writing, that they have complied with Rule G. Additionally, they must attest that through personal observation of their subordinate's appearance and actions, they also are not in violation of Rule G. Thus, the SP has attempted to establish procedures to insure that the performance of SP employees on duty are not impaired by the use of alcohol either immediately before or while on duty.

The conflicting reports by witnesses concerning the alleged use of alcohol by the conductor of train No. 11 on the morning of June 23 makes it virtually impossible to determine when or if his responses to his duty were adversely affected. The Regional Director-Passenger Services did not report any exception to the conductor's condition after having talked to him earlier during the trip in the dining car while the train was en route between Klamath Falls and Dunsmuir. When the Regional Director-Passenger Services detected the alcohol on the conductor's breath at Gibson, he did not observe any impairment in the conductor's speech or actions. In a written statement to a Safety Board investigator, dated August 23, 1982. The SP trainmaster confirmed that he did not take exception to the conductor's condition at Gibson. However, Safety Board investigators learned later during the incident investigation that the trainmaster had been informed by the SP special agent that alcohol had been detected on the conductor's breath, but by that time train No. 11 had departed Gibson. Therefore, the trainmaster was unable to take any action at the accident site. The Road Foreman of Engines-Diesel Supervisor testified that while the conductor was assisting him in separating the rear cars of the train he did not take exception to the conductor's responses or condition.

The conductor did not assume a highly visible, positive role in directing activities at Gibson. Whether this was from a lack of training or because of his possible use of alcohol cannot be determined. Nevertheless, the alcohol issue was not resolved at Gibson, but rather the conductor continued on duty and was not relieved from duty until 6 a.m., when train No. 11 arrived at Redding, nearly 4 1/2 hours after the fire. The SP subsequently dismissed the conductor on a charge that he had violated Rule G.

The Safety Board believes that the conductor of train No. 11 should have been examined carefully and that a determination of possible alcohol use should have been made at the Gibson. The Amtrak Regional Director-Passenger Services' detection of alcohol should have been checked promptly by the appropriate SP official at the incident location and the conductor should have been removed from service if there had been any evidence of the use of alcohol.

Because of its concern that alcohol abuse is a serious problem in the railroad industry, the Safety Board recommended on March 7, 1983, that the FRA:

With the assistance of the Association of American Railroads and the Railway Labor Executives Association, develop and promulgate effective procedures to ensure that timely toxicological tests are performed on all employees responsible for the operation of the train after a railroad accident which involves a fatality, a passenger train, releases of hazardous materials, an injury, or substantial property damage. (R-83-31)

While the Safety Board encourages the SP to continue its efforts to minimize and eliminate the abuse of alcohol, it is clear from this incident that SP officials must act at the accident/incident location to remove any doubt of impairment or use of alcohol by its employees.

## CONCLUSIONS

### Findings

1. Evidence indicated that the Southern Pacific (SP) operating traincrew was in compliance with the SP operating rules before the fire.
2. The engineer stopped the train immediately after the fire was discovered at a place accessible to emergency services.
3. The fire consumed part of one passenger car and heavy smoke permeated three cars.
4. Measures were available to the Amtrak onboard service personnel and the SP operating crew which could have restricted the fire and the spread of smoke.
5. Neither Amtrak nor SP had provided onboard personnel with an organized evacuation plan for use in the event of an emergency.
6. The intercom system in each bedroom of the sleeping cars was not provided with an override feature so that an emergency alarm could be received irrespective of the channel selection switch's position.
7. Passengers were not provided with any information on emergency escape routes or the operation of the emergency facilities in the passenger cars.
8. With few exceptions, the passengers were left to their own devices to escape from the two cars.
9. Amtrak and railroad operating personnel should be given "hands on" training in procedures for emergency evacuation from passenger equipment.
10. The materials used for the interior trim were the best available for fire retardancy and flammability qualities at the time of the design and construction of the superliner cars, with the exception of the polyurethane used in the chair armrests and the passenger service units.

11. The car trim or furnishing component most susceptible to fire was the polyurethane chair armrests and the passenger service units in the bedrooms.
12. The fire most likely originated in bedroom No. 1 of the 1130 car from a lighted cigarette; a smouldering fire was undetected for as long as 3 1/2 hours.
13. The fire spread from the center of the car outward toward both ends.
14. The emergency exit windows were inherently difficult or impossible to remove from inside the car and could neither be identified nor readily removed from the outside.
15. The emergency exit window handle in the economy bedrooms was blocked from view by the upper berth in its lowered position, and it was difficult to reach when the upper berth was lowered.
16. Except for the time it was occupied by the Amtrak supervisors and their visitors, bedroom No. 1 of the 1130 car was vacant before the fire was discovered.
17. In addition to the open upper level end doors, the continued operation of the ventilating systems on the 1131 car, the dining car, and the cafe/lounge cars caused the smoke and fumes to be drawn into those cars.
18. The electrical system was eliminated as a possible source of the fire.
19. While the paper trash containers used on the sleeping cars were not a source of fire in the 1130 car, they are potentially fire hazards.
20. An Amtrak supervisor detected alcohol on the breath of the SP conductor on train No. 11 at Gibson, California.
21. The possible alcohol involvement by the conductor was said to have been reported to an SP Special Agent at Gibson, but even so, the conductor was allowed to continue with train No. 11 to Redding, California.
22. SP supervisors requested the conductor to take a blood alcohol test at Redding, California, to remove any doubt of alcohol involvement, but the conductor refused.
23. Nearly 4 1/2 hours after the fire, the conductor was relieved from duty at Redding, California, and subsequently was dismissed on the charge that he had violated SP Rule "G" which prohibits the use of alcoholic beverages while on duty.

#### **Probable Cause**

The National Transportation Safety Board determines that the probable cause of this accident was the lack of effective response to suppress a fire in bedroom No. 1 of car No. 32010 (1130), and the continued operation of the heating-venting-air conditioning system, which resulted in propagation of the fire and smoke. Contributing to the loss of life, injuries, and damage were the lack of definitive emergency procedures and

inadequate training for onboard Amtrak service and supervisory personnel and Southern Pacific Railroad Company operating crewmembers in fire emergency procedures and the evacuation of passengers. Also contributing to the loss of life, injuries, and damage was heavy and toxic smoke generated by the combustion of flammable materials, such as plastics and elastomers.

## RECOMMENDATIONS

As a result of its investigation of this incident, the National Transportation Safety Board recommended:

—to the National Railroad Passenger Corporation (Amtrak):

Develop and install a central alarm system in sleeping cars to alert passengers occupying sleeping spaces of an emergency. The alarm system should be actuated automatically by strategically located smoke detectors and should simultaneously deactivate the air circulating system. (Class II, Priority Action) (R-83-62)

Study the feasibility of providing an override feature for the intercom system of each bedroom so that an emergency alarm would be received in each bedroom irrespective of the setting of the volume control and channel selection switch. (Class II, Priority Action) (R-83-63)

Provide an emergency escape window exit in each sleeping compartment as well as in all passenger car hallways. (Class II, Priority Action) (R-83-64)

Relocate the handles on the emergency escape window exits in superliner sleeping cars from the top to the bottom of the window giving priority to economy bedrooms where the handle cannot be seen or effectively operated with the upper berth lowered. (Class II, Priority Action) (R-83-65)

Install in each sleeping compartment and all passenger car hallways effective, low mounted emergency lights which will provide a lighted escape path in the event of heavy smoke when an emergency evacuation is required. (Class II, Priority Action) (R-83-66)

Evaluate the effectiveness of the handle design on Amtrak equipment emergency escape window exits to determine that the required operational forces to remove the windows and stripping are within human performance capabilities for the range of potential users and redesign if necessary. (Class II, Priority Action) (R-83-67)

Improve the visibility of markings of emergency escape window exits on superliner cars, and in addition, conspicuously mark the outside of the superliner passenger cars to identify the emergency escape window exits and to provide adequate instructions for their removal. (Class II, Priority Action) (R-83-68)

Discontinue the use of paper trash bags in all passenger trains and install fire proof trash containers. (Class II, Priority Action) (R-83-69)

Conspicuously mark superliner sleeping and passenger car vestibule doors and end doors inside and out to indicate the location and method of operation of the door latch and any safety latch. (Class II, Priority Action) (R-83-70)

Revise applicable sections of Service Manual A to prescribe specific emergency duties and responsibilities for all Amtrak on-board service personnel, relevant to all identifiable potential train accidents, with emphasis on onboard fires and on procedures for notification, evacuation, and post-accident disaster handling of passengers. (Class II, Priority Action) R-83-71)

Include both Amtrak supervisory personnel and onboard service personnel in refresher training programs covering the changes in Amtrak emergency procedures. Arrange with all railroads over which Amtrak trains are operated emergency training for traincrew employees qualified for assignment to passenger service. (Class II, Priority Action) (R-83-72)

Extend the training program for onboard service personnel to require them to demonstrate their ability to operate emergency exits and emergency equipment and to perform assigned emergency responsibilities outlined in the Service Manual A in simulated exercises. (Class II, Priority Action) (R-83-73)

Conduct a one time survey of all passenger cars to identify materials that do not meet current flammability standards or that produce toxic fumes and undertake a systematic program to replace them with materials that meet current flammability, smoke emission, and toxicity standards. (Class II, Priority Action) (R-83-74)

Develop a passenger briefing card or placard with information on the location and operation of emergency exits, fire extinguishers, and first aid kits, and install them in prominent places in the passenger cars and in every bedroom in sleeper cars. In addition, require that the car attendants explain the emergency procedures to the passengers in each bedroom so that they will have an understanding of the car arrangement and the emergency facilities available. (Class II, Priority Action) (R-83-75)

—to the Federal Railroad Administration:

Expedite the development of passenger car safety standards which were mandated by Congress in October 1980 (reiterated January 14, 1983), including in the standards:

- (a) Criteria for the location and intensity of emergency lights within the cars to assure adequate visibility for escape from smoke filled cars;
- (b) Requirements for emergency evacuation plans, for training of personnel for emergencies, and for

emergency systems, such as emergency exits and doors, smoke detector systems, etc., specifying the numbers, type, location, and markings;

- (c) Acceptable levels of flame spread rate, smoke emissions, and toxic fumes for interior materials; and
- (d) Requirements for the installation of a sprinkler system to which water can be supplied by emergency equipment through externally mounted standard standpipes.

(Class II, Priority Action) R-83-76)

**BY THE NATIONAL TRANSPORTATION SAFETY BOARD**

/s/ JIM BURNETT  
Chairman

/s/ PATRICIA A. GOLDMAN  
Vice Chairman

/s/ FRANCIS H. McADAMS  
Member

/s/ G. H. PATRICK BURSLEY  
Member

/s/ DONALD D. ENGEN  
Member

April 19, 1983

## **APPENDIXES**

### **APPENDIX A**

#### **INVESTIGATION**

##### Investigation

The National Transportation Safety Board was advised of the accident about 8:30 a.m. on June 23, 1982 by the National Response Center which relayed the SP's report of the accident. The Safety Board dispatched an investigator from its Fort Worth, Texas Field Office. The investigator arrived at Gibson about 7:00 p.m. on June 23, 1982. On June 24, 1982, he was joined by a Human Factors Engineer and a Mechanical General Engineer from the Safety Board's Washington, D.C. Headquarters. After a preliminary investigation, the accident was upgraded to a major accident and sworn depositions were taken from principals involved in the accident. There were no formally recognized parties to the investigation.

However, investigations were also conducted by the Federal Railroad Administration; the State of California; the Redding, California, Fire Department; the Shasta County Fire Department; the Pullman Standard Company; and a private firm for Amtrak. The information obtained in each investigation was shared by all the investigators.

## APPENDIX B

### SP PERSONNEL INFORMATION

#### Mr. Jerry Winnard Mustard, Engineer

Mr. Jerry W. Mustard, 44, has been an employee of the SP for about 10 years. He was trained as an engineer by attending the SP's engineer training school near Los Angeles and by on-the-job training. He worked as a fireman before he became an engineer. He was assigned the tour of duty as engineer of train No. 11 from the engineer's extra-board out of Dunsmiur. He reported for duty at 12:30 a.m., June 23, 1982, after having the required legal rest period. He was a properly qualified engineer according to SP operating rules and had passed a medical and rules examination satisfactorily during December 1981.

#### Mr. Bobby Lee Jones, Conductor

Mr. Bobby L. Jones, 56, was employed by the SP as a trainman in 1946. He was promoted to conductor in 1955. He reported for duty at Klamath Falls at 9:55 a.m. after the required legal rest period. He passed his last operating rules exam June 2, 1982, and he was qualified for his position according to the SP operating rules. He was trained by on-the-job training. Just before June 23, he had relinquished the position as conductor and took the position of baggagemaster which covered a trip on train No. 11. He was move up to the position of conductor on June 23 because the regularly assigned conductor was off.

There was no evidence to indicate that Mr. Jones was a habitual drinker and his service record did not indicate his having violated rule G before. In this incident, he insisted he took no drink until about 6:15 a.m. when he drank what he said was a cough remedy.

#### Mr. Preston Neal Shelton, Rear Brakeman

Mr. Preston N. Shelton, 41, was employed by the SP on July 7, 1961. About 1968, he was promoted to conductor. He was qualified for his position on train No. 11 according to the SP operating rules, having passed his last operating rules examination on June 4, 1982. He is a regularly assigned freight brakeman on the freight brakeman extra board and he was called for the position of rear brakeman on train No. 11 because no other passenger brakemen were available. He reported for duty at Klamath Falls at 9:55 p.m. on June 22, 1982, after having the required rest period.

#### Mr. Billy Ted Audess, Head Brakeman

Mr. Billy T. Audess, 55, was employed by the SP as a brakeman on September 20, 1955. He was promoted to conductor in 1961. He was qualified for his position as head brakeman according to the SP operating rules, having passed his last operating rules examination on June 2, 1982. He reported for duty on this assignment at 9:55 p.m. on June 22 at Klamath Falls after having the required legal rest period. He was a regularly assigned to the passenger train extra board and he was called to fill a vacancy on train No. 11 on June 22, 1982.



## APPENDIX C

### AMTRAK PERSONNEL INFORMATION

#### Ms. Brenda Johnson, Car Attendant - 1130

Ms. Brenda Johnson, 26, had been employed by Amtrak since May 23, 1979, as a service attendant. She began working as a train attendant on April 30, 1980. At the time of the incident, she had not been trained on the superliner cars. During the last week of May 1982, she transferred from Washington, D.C. to Los Angeles. At the time of the incident, she was making her fourth trip in superliner service between Los Angeles and Seattle. She had begun her tour of duty out of Los Angeles on June 20, about 7:30 a.m. on a trip northward. She was off duty from about 11:00 p.m., June 21st until about 10:00 a.m., June 22, 1982. She had been presented copies of Amtrak's Service Manual A and their book of Safety Rules, which the attendant was honor bound to read.

#### Ms. Ruth Wong, Car Attendant - 1131

Ms. Ruth Wong, was employed by Amtrak in September 1979 as a reservation clerk. In May 1980, she attended the training school for train attendants and began working on board Amtrak trains. She was not regularly assigned to Amtrak trains Nos. 14 (to Seattle) or 11 but she was working from an extra-board and was called for this tour of duty.

#### Mr. Michael Wikman, Road Foreman of Engines-Diesel Supervisor

Mr. Michael Wikman, was employed by the Pennsylvania Railroad about 27 years ago. He had advanced through promotions from fireman to engineer to Road Foreman of Engines, a position he had been serving in at the time of the incident, for about 15 years of which about 5 years had been with Amtrak. In this position, he has systemwide responsibility, except for the Northeast Corridor.

#### Mr. Kenneth C. Clauson, Regional Director, - Passenger Services

Mr. Kenneth C. Clauson began his railroad career with the Great Northern Railway. He served in various capacities as City Passenger Agent, Traveling Passenger Agent, and General Agent-Passenger Department. On March 1, 1970, he transferred to Seattle, Washington, as Assistant Regional Manager of Sales and Service. He began working with Amtrak on May 1, 1973; he joined Amtrak as Manager of Stations and later became Regional Director-Passenger Services, assigned to Seattle, Washington.

**APPENDIX D**  
**FLAMMABILITY AND SMOKE EMISSION**  
**STANDARDS**  
**SUPERLINER SLEEPING CAR**

<u>Item</u>	<u>Material</u>	<u>Test Reference</u>	
		<u>Flammability</u>	<u>Smoke Emission</u>
<u>Amtrak Supplied Material:</u>			
Armrest - all	Self skinning polyurethane	fails 1	meets 2
Drapery - all	Wool, nylon - Boris Kroll	meets 1	meets 2
Floor - Carpet/Aisles	Industry Park, Lees	meets 1	N/R
Carpet/Room Econ	Protector, Lees	meets 1	N/R
Carpet/Room-Dlx	Design IV, Lees		
Lighting - Bezels, Facias	Lexan, glass filled	meets 1	meets 2
Seats - cushions	Neoprene - Toyad	meets 1	N/R
covers	Wool/nylon - Boria Kroll	meets 1	meets 2
shrouds (Isclass)	Glass filled Lexan	meets 1	meets 2
hardware	Painted metal	meets 1	meets 2
Shower module	Fyropof	meets 1	meets 2
Tray tables - all	Glass filled Lexan	meets 1	meets 2
Carpet - walls/bunk	CC D-1771	meets 1	meets 2
Mattress	Neoprene	meets 1	N/R
Ticking	Cotton (CCC-C-346)	meets 1	
	Type II class 2		
Passenger service units	Self skinning polyurethane	fails 1	meets 2
<u>PS Supplied Material:</u>			
Upper berths	FRP	meets 1	fails 2
Tray tables			

<u>Item</u>	<u>Material</u>	<u>Test Reference</u>	
		<u>Flammability</u>	<u>Smoke Emission</u>
Vertical partitions	Mel. & met. clad plywood	meets 3,1	meets 2
Rubber flooring	RCA 707		
Carpet adhesive	Water based latex	See note 7	
Aisle sash	Elastomer	6	6
Handicapped Bedroom:			
Melamine cabinet	Mel. & Met. clad plywood	meets 1	meets 2
Accessory shelf	Mel. & Met. clad plywood	meets 1	meets 2
Cabinet (underneath)	Mel. & Met. clad plywood	meets 1	meets 2
Pilaster	Mel. & Met. clad plywood	meets 1	meets 2
Toilet shroud	FRP	meets 1	fails 2
Sink shroud	FRP	meets 1	fails 2
Floor pan	FRP	meets 1	fails 2
Kick plate	S/S clad plywood	meets 1	meets 2
Hamper, front	S/S clad plywood	meets 1	meets 2
Interior Finish Common Items:			
Manus 56A WB 101	One part polysulphide	No real flash point	
JM 1099 adhesive		T = 15°F flash	
Arm'g 520 adhesive		ASTM-162 F/S 25	ASTM-162 Smoke = 0
Permagum 5452		6	6

Item	Material	Test Reference	
		Flammability	Smoke Emission
Cellf. PVC Cement		6	6
3M-38		No flash point. NFPA 90-A	
J-1114 Cement		6	6
3M 2216B/A		6	6
Armaflex tape	Closed cell elastomer	Tested to ASTM-1692	
Nashua 673	Cork tape	6	6
Nashua FR-357		U.L. 723 F/S = 0	Fuel contr. = 0; Smoke = 0
Carpet seaming			
Linen tape	Cotton	6	6
Corx tape	Felt	6	6
Carp adhesive 3M-77		6	6
Presswood filler	Presswood	Burns readily	
RTV sealant	Silicone sealant	UL E-36952A T resist = 600°F	
Nashua 323	Aluminum foil tape MELT	T = 1,200°F Fuel consumed smoke = 0	
Manus #37AG		6	6
Ribbon tape		6	6
Vinyl tape		6	6
Insulating tape (FR)		6	6

<u>Item</u>	<u>Material</u>	<u>Test Reference</u>	
		<u>Flammability</u>	<u>Smoke Emission</u>
Sound deadener	ViscoElastic Cd. Water Base	meets 1	
Insulating tape		6	6
Foam tape	Polyester		
Foam tape	PVC	6	6
Window sash	Elastomer	6	6
Armaflex pipe ins.	Elastomer	Tested to ASTM-84	
Wire:			
Hypalon wire (AAR 589)	Chloro-sulfonated polyethylene	6	6
PVC wire	Poly-vinyl chloride	6	6
XLPVC wire	Irradiated poly-vinyl chloride, MIT-W-1687811	6	6
Exane XPL wire	Cross linked polyolefin, Exane ITT Surprenant	6	6
Halar wire	Ethylene - Chloro- Tetra - Fluoro - Ethylene	6	6
Neoprene wire	AAR 581	6	6
PVC wire ducts	Poly-vinyl chloride	6	6

Bi-Level Cars  
Flammability and Smoke Emission Study  
Reference Documents

1. Part 1.0 of "Guidelines for Flammability and Smoke Emission" (covers flammability) UMTA D.O.T. Guidelines.
2. Part 2.0 of "Guidelines for Flammability and Smoke Emission" (covers smoke emission) UMTA D.O.T. Guidelines.
3. FAR 25.853 (a) (covers flammability).
4. FAR 25.853 (b) (covers flammability).
5. ASTM E-162 (which exceeds Amtrak Specification, Section 2.2.11.4, page 85).
6. No meaningful test data available or no data supplied by Pullman Standard.
7. Water based latex with flame spread index of 40 (probably). Test of composite to be run. Data sheet classifies the cement as "Non-flammable".
8. Carpet and/or tile, plywood floor, floor insulation, and sub-floor sheet must be tested as a composite structure per ASTM E-119.
9. Federal specification CCC-C-436, latest revision, "Cloth, Ticking Twill, Cotton." Type II Class 2.

§ 25.853 - Compartment Interiors.

Materials (including finishes or decorative surfaces applied to the materials) used in each compartment occupied by the crew or passengers must meet the following test criteria as applicable:

(a) Interior ceiling panels, interior wall panels, partitions, galley structure, large cabinet walls, structural flooring, and materials used in the construction of stowage compartments (other than underseat stowage compartments and compartments for stowing small items such as magazines and maps) must be self-extinguishing when tested vertically in accordance with the applicable portions of Appendix F of this part, or other approved equivalent methods. The average burn length may not exceed 6 inches and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of 3 seconds after falling.

(b) Floor covering, textiles (including draperies and upholstery), seat cushions, padding, decorative and non-decorative coated fabrics, leather, trays and galley furnishings, electrical conduit, thermal and acoustical insulation and insulation covering, air ducting, joint and edge covering, cargo compartment liners, insulation blankets, cargo covers, and transparencies, molded and thermoformed parts, air ducting joints, and trim strips (decorative and chafing), that are constructed of materials not covered in paragraph (b-2) of this section, must be self-extinguishing when tested vertically in accordance with the applicable portions of Appendix F of this part, or other approved equivalent methods. The average burn length may not exceed 8 inches and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of 5 seconds after falling.

(b-1) Motion picture film must be safety film meeting the Standard Specifications for Safety Photographic Film PII 1.25 (available from the United States of America Standards Institute, 10 East 40th Street, New York, NY 10018), or an FAA-approved equivalent. If the film travels through ducts, the ducts must meet the requirements of paragraph (b) of this section.

(b-2) Acrylic windows and signs, parts constructed in whole or in part of elastomeric materials, edge lighted instrument assemblies consisting of two or more instruments in a common housing, seat belts, shoulder harnesses, and cargo and baggage tie-down equipment, including containers, bins, pallets, etc., used in passenger or crew compartments, may not have an average burn rate greater than 2.5 inches per minute when tested horizontally in accordance with the applicable portions of Appendix F of this part, or other approved equivalent methods.

(b-3) Except for electrical wire and cable insulation, and for small parts (such as knobs, handles, rollers, fasteners, clips, grommets, rub strips, pulleys, and small electrical parts) that the Administrator finds would not contribute significantly to the propagation of a fire, materials in items not specified in paragraphs (a), (b), (b-1), or (b-2) of this section may not have a burn rate greater than 4 inches per minute when tested horizontally in accordance with the applicable portions of Appendix F of this part or other approved equivalent methods.

(c) If smoking is to be prohibited, there must be a placard so stating, and if smoking is to be allowed—

(1) There must be an adequate number of self-contained, removable ashtrays; and

(2) Where the crew compartment is separated from the passenger compartment, there must be at least one sign meeting the "No Smoking" sign requirements of § 25.791 notifying all passengers when smoking is prohibited.

(d) Each disposal receptacle for towels, paper, or waste must be fully enclosed and constructed of at least fire resistant materials, and must contain fires likely to occur in it under normal use. The ability of the disposal receptacle to contain those fires under all probable conditions of wear, misalignment, and ventilation expected in service must be demonstrated by test. A placard containing the legible words "No Cigarette Disposal" must be located on or near each disposal receptacle door.

(e) Lavatories must have "No Smoking" or "No Smoking in Lavatory" placards located conspicuously on each side of the entry door, and self-contained removable ashtrays located conspicuously on or near the entry side of each lavatory door, except that one ashtray may serve more than one lavatory door if the ashtray can be seen readily from the cabin side of each lavatory door served. The placards must have red letters at least one-half inch high on a white background of at least one inch high. (A "No Smoking" symbol may be included on the placard.)

(Sec. 604, 72 Stat. 778; 49 U.S.C. 1424)

(Doc. No. 5086, 29 FR 18291, Dec. 24, 1964, as amended by Amdt. 25-23, 35 FR 5676, Apr. 8, 1970; Amdt. 25-32, 37 FR 3971, Feb. 24, 1972; Amdt. 25-51, 45 FR 7755, Feb. 2, 1980)



## APPENDIX F

An acceptable Test Procedure for showing compliance with §§ 25.853, 25.855, and 25.1359.

(a) *Conditioning.* Specimens must be conditioned to 70° F, plus or minus 5° and at 50 percent plus or minus 5 percent relative humidity until moisture equilibrium is reached or for 24 hours. Only one specimen at a time may be removed from the conditioning environment immediately before subjecting it to the flame.

(b) *Specimen configuration.* Except as provided for materials used in electrical wire and cable insulation and in small parts, materials must be tested either as a section cut from a fabricated part as installed in the airplane or as a specimen simulating a cut section, such as: A specimen cut from a flat sheet of the material or a model of the fabricated part. The specimen may be cut from any location in a fabricated part; however fabricated units, such as sandwich panels, may not be separated for test. The specimen thickness must be no thicker than the minimum thickness to be qualified for use in the airplane, except that: (1) Thick foam parts, such as seat cushions, must be tested in ¼-inch thickness; (2) when showing compliance with § 25.853 (b-3) for materials used in small parts that must be tested, the materials must be tested in no more than ¼-inch thickness; (3) when showing compliance with § 25.1359(d) for materials used in electrical wire and cable insulation, the wire and cable specimens must be the same size as used in the airplane. In the case of fabrics, both the warp and fill direction of the weave must be tested to determine the most critical flammability conditions: When performing the tests prescribed in paragraphs (d) through (e) of this appendix, the specimen must be mounted in a metal frame so that: (1) in the vertical tests of paragraph (d), the two long edges and the upper edge are held securely; (2) in the horizontal test of paragraph (e), the two long edges and the edge away from the flame are held securely; (3) the exposed area of the specimen is at least 2 inches wide and 12 inches long, unless the actual size used in the airplane is smaller; and (4) the edge to which the burner flame is applied must not consist of the finished or protected edge of the specimen but must be representative of the actual cross-section of the material or part installed in the airplane. When performing the test prescribed in paragraph (f) of this appendix, the specimen must be mounted in a metal frame so that all four edges are held securely and the exposed area of the specimen is at least 8 inches by 8 inches.

(c) *Apparatus.* Except as provided in paragraph (b) of this appendix, tests must be conducted in a draft-free cabinet in accordance with Federal Test Method Standard 191 Method 5903 (revised Method 5902) for the vertical test, or Method 5906 for horizontal test (available from the General Services Administration, Business Service Center, Region 3, Seventh and D Streets SW, Washington, DC 20407) or other approved equivalent methods. Specimens which are too large for the cabinet must be tested in similar draft-free conditions.

(d) *Vertical test, in compliance with § 25.853 (a) and (b).* A minimum of three specimens must be tested and the results averaged. For fabrics, the direction of weave corresponding to the most critical flammability conditions must be parallel to the longest dimension. Each specimen must be supported vertically. The specimen must be exposed to a Bunsen or Tirrill burner with a nominal ¾-inch I.D. tube adjusted to give a flame of 1½ inches in height. The minimum flame temperature measured by a calibrated thermocouple pyrometer in the center of the flame must be 1,550° F. The lower edge of the specimen must be three-fourths inch above the top edge of the burner. The flame must be applied to the center line of the lower edge of the specimen. For materials covered by § 25.853(a), the flame must be applied for 60 seconds and then removed. For materials covered by § 25.853(b), the flame must be applied for 12 seconds and then removed. Flame time, burn length, and flaming time of drippings, if any, must be recorded. The burn length determined in accordance with paragraph (g) of this appendix must be measured to the nearest one-tenth inch.

(e) *Horizontal test in compliance with § 25.853 (b-2) and (b-3).* A minimum of three specimens must be tested and the results averaged. Each specimen must be supported horizontally. The exposed surface when installed in the aircraft must be face down for the test. The specimen must be exposed to a Bunsen burner or Tirrill burner with a nominal ¾-inch I.D. tube adjusted to give a flame of 1½ inches in height. The minimum flame temperature measured by a calibrated thermocouple pyrometer in the center of the flame must be 1,550° F. The specimen must be positioned so that the edge being tested is three-fourths of an inch above the top of, and on the center line of, the burner. The flame must be applied for 15 seconds and then removed. A minimum of 10 inches of the specimen must be used for timing purposes, approximately 1½ inches must burn before the burning front reaches the timing zone, and the average burn rate must be recorded.

(f) *Forty-five-degree test, in compliance with § 25.855 (a-1).* A minimum of three specimens must be tested and the results averaged. The specimens must be supported at an angle of 45° to a horizontal surface. The exposed surface when installed in the aircraft must be face down for the test. The specimens must be exposed to a Bunsen or Tirrill burner with a nominal ¾-inch I.D. tube adjusted to give a flame of 1½ inches in height. The minimum flame temperature measured by a calibrated thermocouple pyrometer in the center of the flame must be 1,550° F. Suitable precautions must be taken to avoid drafts. One-third of the flame must contact the material at the center of the specimen and must be applied for 30 seconds and then removed. Flame time, glow time, and whether the flame penetrates (passes through) the specimen must be recorded.

(g) *Sixty-degree test in compliance with § 25.1359(d).* A minimum of three specimens of each wire specification (make and size)

must be tested. The specimen of wire or cable (including insulation) must be placed at an angle of 60° with the horizontal in the cabinet specified in paragraph (c) of this appendix with the cabinet door open during the test or must be placed within a chamber approximately 2 feet high x 1 foot x 1 foot, open at the top and at one vertical side (front), and which allows sufficient flow of air for complete combustion, but which is free from drafts. The specimen must be parallel to and approximately 6 inches from the front of the chamber. The lower end of the specimen must be held rigidly clamped. The upper end of the specimen must pass over a pulley or rod and must have an appropriate weight attached to it so that the specimen is held tautly throughout the flammability test. The test specimen span between lower clamp and upper pulley or rod must be 24 inches and must be marked 8 inches from the lower end to indicate the central point for flame application. A flame from a Bunsen or Tirrill burner must be applied for 30 seconds at the test mark. The burner must be mounted underneath the test mark on the specimen, perpendicular to the specimen and at an angle of 30° to the vertical plane of the specimen. The burner must have a nominal bore of three-eighths inch, and must be adjusted to provide a 3-inch-high flame with an inner cone approximately one-third of the flame height. The minimum temperature of the hottest portion of the flame, as measured with a calibrated thermocouple pyrometer, may not be less than 1,750° F. The burner must be positioned so that the hottest portion of the flame is applied to the test mark on the wire. Flame time, burn length, and flaming time of drippings, if any, must be recorded. The burn length determined in accordance with paragraph (g) of this appendix must be measured to the nearest one-tenth inch. Breaking of the wire specimens is not considered a failure.

(h) *Burn length.* Burn length is the distance from the original edge to the farthest evidence of damage to the test specimen due to flame impingement, including areas of partial or complete consumption, charring, or embrittlement, but not including areas sooted, stained, warped, or discolored, nor areas where material has shrunk or melted away from the heat source.

[Amdt. 25-32, 37 FR 3972, Feb. 24, 1972; 37 FR 5284, Mar. 14, 1972]

## APPENDIX E

### AMTRAK SPECIFICATION FOR FLAMMABILITY AND SMOKE EMISSION

SPECIFICATION NUMBER GEN-S-014-001, Revision "C"

April 17, 1978

The following specifications for flammability are for application to combustible materials used on intercity passenger systems. This specification will be revised periodically to reflect the certification of better standards and improved materials. B

#### 1.0 Flammability

Scope - These specifications relate to all combustible materials used in an intercity passenger system, and include seats, seat cushions, upholstery, flooring, carpeting, wall and ceiling panels, plastic glazing, lighting diffusers, thermal and acoustical insulation, electrical insulation, elastomers and ducting.

1.1 Seat cushions and thermal and acoustical insulation shall be capable of passing the ASTM-E-162-67 Radiant Panel Test with a flame propagation index (Is) not exceeding 25. Additional provisions are as follows:

- (a) There shall be no flaming, running, or dripping;
- (b) Wire mesh screening shall be used (as per section 4.9.2 of ASTM-E-162);
- (c) A 6-inch long pilot flame shall be used (burner tip situated 1-1/4" beyond the frame to prevent extinguishment);
- (d) Aluminum foil shall be used to wrap around the back and sides of the specimen.

The fire-resistant properties of the materials shall be demonstrated to be permanent by washing according to Federal Test Method 191b, Method 5830.

1.2 Wall and ceiling panels, windscreens, seat frames, seat shrouds, partitions and ducting shall be capable of passing the ASTM-E-162-67 Radiant Panel Test with a flame propagation index (Is) not exceeding 35, with the added provision that there shall be no flaming drippings.

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FLAMMABILITY AND SMOKE EMISSION  
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April 17, 1978

- 1.3 Upholstery materials shall be tested by F.A.A. Regulation 25.853 vertical test, Appendix F(b), with the following modifications:
- (a) the average flame time after removal of the flame source may not exceed 10 seconds;
  - (b) burn length shall not exceed 6 inches;
  - (c) flaming dripping shall not be allowed;
  - (d) fabrics that must be machine washed or dry-cleaned must meet the requirements of 1.3a, b, and c, after leaching according to Federal Test Method 191b, Method 5830, or after dry-cleaning according to AATCC\* 86-1968. Fabrics that cannot be machine washed or dry-cleaned must be so labeled and pass the leaching test as well as 1.3a, b, and c after being cleaned as recommended by the manufacturer.
- 1.4 Carpeting shall be tested with its padding, if the latter is to be used, and shall be capable of passing the NBS Flooring Radiant Panel Test, NBSIR-74-495, with a minimum critical radiant flux of 0.6 watts/cm<sup>2</sup>.
- 1.5 Plastic windows and lighting diffusers shall be capable of passing the ASTM-E-162-67 Radiant Panel Test with a flame propagation index (Is) not exceeding 100.
- 1.6 Flooring shall be capable of withstanding the requirements of ASTM-E-119 when exposed for 15 minutes up to 1400 degrees F (760 degrees C) on its underside.
- 1.7 Elastomers shall be capable of passing the requirements of ASTM-C-542-71A, with the added requirement that there be no flaming dripping.

\*AATCC - American Association of Textile Chemists and Colorists.

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FLAMMABILITY AND SMOKE EMISSION  
SPECIFICATION NUMBER GEN-S-014-001, Revision "C"

April 17, 1978

1.8 Electrical Insulation

- (a) Wires for control, lighting, auxiliary circuits, speaker, public address, intercom system and the like shall be tested according to IPCEA-NEMA\* S-19-81, paragraph 6.19.6 or Underwriters Laboratory Standard 62. The FR-1 restriction shall be applied to this test.

Note: There is no standard test method for assuring circuit integrity of this type of wire during and after exposure to flame. However, it is required that an insulating char or residue remain on the specimen wires in order to maintain continuity of service.

- (b) High-voltage cable shall be tested according to the IEEE Standard 383-1974. A further provision of this test is that circuit integrity shall continue for five minutes after the start of the test.

2.0 Smoke Emission

Scope - This specification relates to all combustible materials as listed in 1.0 with exceptions as noted.

- 2.1 All materials shall be tested for smoke emission in accordance with the National Fire Protection Association Standard No. 258, "Smoke Generated by Solid Materials," (1974). The optical density,  $D_s$ , in both flaming and non-flaming modes, determined in accordance with the test, shall have the following limits:

- (a) For upholstery, air ducting, thermal insulation, and insulation covering, the  $D_s$  may not exceed 100 within 4 minutes after the start of the test.
- (b) For all other materials, with the exception of foam seat cushioning, electrical insulation and carpeting, the  $D_s$  may not exceed 100 within 90 seconds

\*IPCEA - Insulated Power Cable Engineers Association  
NEMA - National Electrical Manufacturers Association

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FLAMMABILITY AND SMOKE EMISSION  
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after the start of the test, and may not exceed 200 within 4 minutes after the start of the test.

Note: Test procedures for electrical insulation will be published as soon as such procedures have been finalized. In the interim, known heavy smoking insulation such as PVC and chlorinated, sulfonated polyethylene must be avoided.

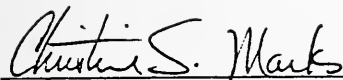
### 3.0 Toxic Gas Emission

At the present time, there are no acceptable toxicity standards that can be applied to the types of materials listed above. It is hoped that such standards will soon become available, if only as preliminary standards.

SPECIFICATION NUMBER GEN-S-014-001  
REVISION "C"

AMTRAK - SPECIFICATION FOR FLAMMABILITY  
AND SMOKE EMISSION

April 17, 1978

A handwritten signature in cursive script, reading "Christine S. Marks", written over a horizontal line.

CHRISTINE S. MARKS  
Engineer - Materials and  
Furnishings Specifications

A handwritten signature in cursive script, reading "Raul V. Bravo", written over a horizontal line.

RAUL V. BRAVO  
Director - Industrial Design

## APPENDIX F

### EXCERPTS FROM REPORTS OF OTHER INVESTIGATING GROUPS INVESTIGATING FIRE ONBOARD AMTRAK TRAIN NO. 11 AT GIBSON, CALIFORNIA, JUNE 23, 1982

Origin: Excerpt from Report of Mr. Ron Hall of Ron Hall Investigations Fire  
Cause Consultants  
1011 St. Andrews Drive, Suite D  
El Dorado Hills, California 95630

#### OPINIONS AND CONCLUSIONS

Utilizing indicators of heat, smoke and burn patterns, flame spread, depth, size and type of char, wind direction, burn progression and degree of destruction, as well as other indicators commonly used to determine type, duration, origin and cause of fire, coupled with the statements of witnesses on the scene prior and during the fire, it is my opinion that:

1. The fire originated in compartment #1, a economy bedroom, located in the center section of the second level. The fire originated at a point where the seat cushion made contact with the back in the northeast section of the compartment. The fire then extended upward from within that area across the surface of the seat back toward ceiling level and began to bank down on the southern section of the compartment. The fire then spread rapidly through the open door assembly out into the corridor area, where it traveled laterally both to the north, as well as the south, throughout the remainder of the car.
2. After ruling out the probability of a failure of the electrical wiring within compartment #1, as well as a failure, malfunction or combustible materials placed against the heating system, as well as all other accidental causes and finding no evidence to substantiate an incendiary fire, it is my opinion that the most probable cause of the fire was due to careless use of smoking materials by person or persons unknown.

Origin: Excerpt from Report of Mr. Tom Hanton from the Office of the State  
Fire Marshall (California) Arson and Bomb Unit,  
7171 Bowling Dr., Suite 600  
Sacramento, California 95823

Except for two smaller areas of somewhat heavier damage in Room 1 (the rear front seat and the ceiling area for example), this fire appears to have started in Room E. If, in fact, the fire started in Room 1 and spread to Room E across the vestibule instead of to Room 3, an explanation had to be found.

One witness, Johnson, saw flames in Room 1. Another witness (I do not have his statement at this time) observed what he thought to be flames appearing through the window of Room 1 or the left side of the vestibule before fire appeared on the right side. The most severely damaged windows were on the right side of the coach. Fire emanating from Room 1 would well have soon filled the car with heavy smoke. Combustion would have decreased due to the lack of oxygen until the train was stopped and the lower doors opened. At that time fresh air at the stairway would have fed the flames. (We know that the connecting doors to the adjacent cars were closed during the early stages of the fire



because of door window glass staining.) As soon as one or more of the upper windows broke out, a strong draft up the stairs would have fanned the fire to an intense level. This draft would have focused on the right end of the front wall of Room E. The result could have focused on the right end of the front wall of Room E. The result could have caused the extreme destruction to Room E. Less air may have gotten to Room 1 with the resulting fire less intense.

Conclusion:

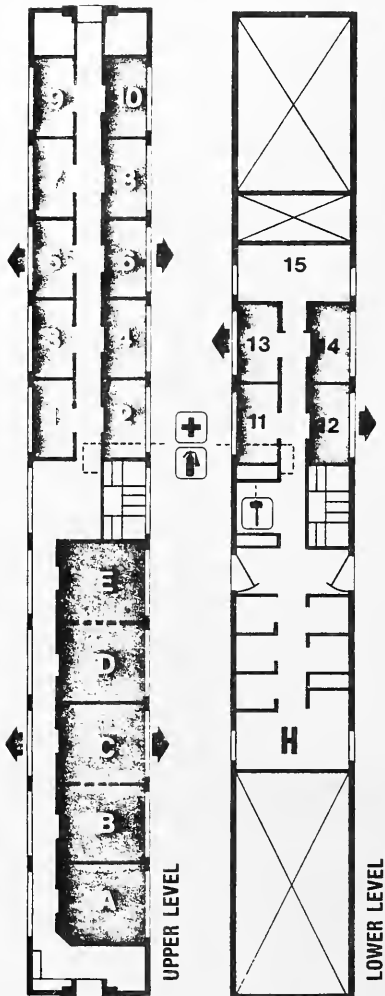
This blow torch action from air rushing up the stairs went on for well over an hour with the resulting burnout to Room E and may have caused me to come to an erroneous preliminary conclusion as to the origin of the fire in Room E.

It is known that several Amtrak employees had been in Room 1 two to three hours prior to the fire. This time frame is well within the limits of a smoker related fire. A burning cigarette wedged between the rear cushion and back could have caused the fire since similar conditions have caused similar fires many times. While the cushion covering may have been flame retardant, the foam cushions (plastic foam) were not.

I cannot state what the cause of this fire was. As with the cause itself, there is no evidence of arson, and the case should be closed, as far as this office is concerned.

## APPENDIX G

### AMTRAK HANDOUT - EMERGENCY EXIT INSTRUCTIONS

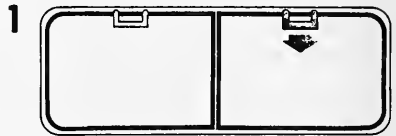


- |                 |                  |
|-----------------|------------------|
| Deluxe Bedrooms | Emergency Exits  |
| Family Bedroom  | Economy Bedrooms |
| Special Bedroom | Toilets          |

### Emergency Exit Instructions

In the event of an accident, normal exits may be blocked or inaccessible. In such cases, passengers should use the specially marked, removable windows to leave the car. The location of these windows is indicated by RED arrows on the car floor plan.

To remove one of the specially marked windows, please follow the directions below.



Locate RED plastic handle on window and pull handle towards you.



Use RED handle to strip away rubber molding.



Locate metal handle on window and pull towards you to remove window pane.

### Emergency Equipment

First aid kits, fire extinguishers, and emergency tools are located on both levels of the Sleeping Car. The location of these items is indicated on the car floor plan by the following symbols.



First Aid Kit



Fire Extinguisher



Emergency Tools

## **TRAIN EMERGENCY:**

**WHEN OPERATION OF THE  
TRAIN ENDANGERS THE SAFETY  
OF PEOPLE OR EQUIPMENT.**

### **WHEN TO EVACUATE?**

**WHENEVER STAYING IN THE CAR  
MEANS A CONTINUING THREAT TO THE  
PEOPLE INSIDE.**

## **IMPORTANT POINTS:**

### **If there is a fire on board:**

1. Turn off Blower Selector Switch
2. Notify Operating Crew Member
3. Investigate and Control
4. EVACUATE THE CAR

### **Steps in Evacuating:**

1. Remain Calm
2. Notify Train Crew Member
3. Notify Passengers of Emergency and Evacuation Plan
4. Provide Assistance as Needed
5. DOUBLE-CHECK THE CAR TO INSURE EVERYONE IS OUT

APPENDIX H

NTSB RESPONSE TO UMTA DOCKET NO. 82-C AND COPY OF DOCKET NO. 82-C

25 JAN 1983

Docket Clerk  
UMTA Docket No. 82-C  
Urban Mass Transportation Administration  
Washington, D.C. 20590

Sir:

The National Transportation Safety Board has reviewed your Notice and Request for Public Comment on "Recommended Fire Safety Practices for Rail Transit Materials Selection," Docket No. 82-C, which was published at 47 FR 53559 on November 26, 1982. In general, the Safety Board supports your proposed recommended fire safety practices for testing flammability and smoke emission characteristics of materials used in the construction of rapid rail transit (RRT) and light rail transit (LRT) vehicles. The promulgation of voluntary guidelines is responsive in part to Safety Board Recommendation R-79-54 made after the fire on the Bay Area Rapid Transit District train on January 17, 1979; and Safety Board Recommendations R-81-6, R-81-11 and R-81-13 issued January 22, 1981, with the Safety Board's report "Safety Effectiveness Evaluation of Rail Rapid Transit Safety."

However, the Safety Board believes that the Urban Mass Transportation Administration's safety practices should include guidelines with respect to the toxicity characteristics and testing of materials used in the construction of RRT and LRT vehicles. There has been an increase in the use of non-metallic, flammable materials such as plastics and elastomers within the enclosed space of a rail transit car. In a fire incident, combinations of these plastics and elastomers may involve toxic emissions far different from those which would be identified when the materials are tested separately. For example, some materials have the propensity to ignite in a fire and if these materials come in contact with other materials which smolder, or otherwise emit smoke or fumes, the combination can produce dangerous toxic gases. In some cases the gases generated by one material are benign yet if they are placed in combination with heat and the combustion products of other burning materials, a lethal gas is formed. Guidelines for appropriate testing procedures and recommending that such materials not be used together in transit car construction, if the potential for the emission of harmful gases is established, would further reduce the risks in a fire incident to transit passengers and employees and to responding emergency service personnel.

- 2 -

The Safety Board appreciates the opportunity to comment on the recommended fire safety practices and believes that the use of these tests for flammability and smoke emission by the transit industry with careful monitoring by the UMTA will further improve safety.

Respectfully yours,

ORIGINAL SIGNED BY  
PATRICIA GOLDMAN

Jim Burnett  
Chairman

## Urban Mass Transportation Administration

### Recommended Fire Safety Practices for Rail Transit Materials Selection

**AGENCY:** Urban Mass Transportation Administration, DOT.

**ACTION:** Notice and request for public comment.

**SUMMARY:** The Urban Mass Transportation Administration (UMTA) is issuing for public comment recommendations for testing flammability and smoke emission characteristics of materials used in the construction of rapid rail transit (RRT) and light rail transit (LRT) vehicles. These recommendations are based on the Transportation Systems Center's "Proposed Guidelines for Flammability and Smoke Emission Specifications," which the transit industry, in general, uses on a voluntary basis.

**DATE:** Comments must be received by January 25, 1983.

**ADDRESS:** Comments must be submitted to UMTA Docket No. 82-C, U.S. Department of Transportation, Urban Mass Transportation Administration, Room 9228, 400 7th Street SW., Washington, DC 20590. All comments and suggestions received will be available for examination at the above address between 8:30 a.m. and 5:00 p.m., Monday through Friday. Receipt of comments will be acknowledged by UMTA if a self-addressed, stamped postcard is included with each comment.

**FOR FURTHER INFORMATION CONTACT:** Lloyd G. Murphy, U.S. Department of Transportation, Urban Mass Transportation Administration, Safety and Security Staff, Room 6431, 400 7th Street SW., Washington, DC 20590, -Telephone: (202) 426-2896.

**SUPPLEMENTARY INFORMATION:** Comments will be considered to determine if the "Recommended Fire Safety Practices for Transit Materials Selection," should be modified.

### Background

The threat of fire in RRT and LRT vehicles is of major concern considering the large number of passengers carried on the vehicles and the high capital investment involved. An analysis, conducted by the Urban Mass Transportation Administration (UMTA), indicated that fire and smoke incidents represent between one and five percent of all rail incidents. Although the occurrence of severe transit fires is rare,

the potential for fire is always present, and once ignition occurs and a fire spreads, life threatening situations may develop.

Recent trends in the design and construction of RRT and LRT vehicles have resulted in the increased use of flammable, non-metallic materials such as plastics and elastomers for transit vehicle components. In many instances, these materials are more flammable than the existing materials they replace and, therefore, increase the fire threat in the transit vehicle. This fire threat can be reduced or limited by minimizing adverse effects from the use of these non-metallic materials in the manufacture of transit vehicles and components. This may be accomplished by considering the materials' flammability and smoke emission characteristics in the materials selection process. The choice of materials in some RRT and LRT vehicles shows that the fire threat associated with these non-metallic materials may not be recognized or appreciated by designers. The flammability and smoke emission characteristics of materials may have been overlooked, and the materials may have been selected for other desirable properties such as wear, impact resistance, maintainability, weight, etc.

In 1973, UMTA, as part of its mission to improve mass transportation, initiated an effort to evaluate and improve fire safety in transit vehicles. In 1974, "Proposed Guidelines for Flammability and Smoke Emission Specifications" of materials used in transit vehicles (Guidelines) were developed by the Transportation Systems Center (TSC) for UMTA. Since that time, these Guidelines have undergone periodic review and updating.

An investigatory report on the Bay Area Rapid Transit District (BARTD) fire of January 17, 1979, by the National Transportation Safety Board, resulted in Safety Recommendation F-79-54 dated August 2, 1979, which recommended that the Urban Mass Transportation Administration promulgate: "minimum fire safety standards for the design and construction of rapid transit vehicles."

Initially, UMTA intended to issue fire safety practices as a regulation; however, as noted in the Semi-annual Regulations Agenda of April 1981, this regulatory action was withdrawn, and the decision was made to publish the fire safety practices in the Federal Register as a recommendation.

## Scope

The Recommended Fire Safety Practices for Transit Materials Selection are directed at improving the vehicle interior materials selection practices for the procurement of new vehicles and the retrofit of existing RRT and LRT vehicles. Adoption of these recommended fire safety practices will help to minimize the fire threat in transit vehicles and, thereby, reduce the injuries and damage resulting from vehicle fires.

## Recommended Fire Safety Practices for Transit Materials Selection

### Application

This document provides recommended fire safety practices for testing the flammability and smoke emission characteristics of materials used in the construction of RRT and LRT vehicles.

### Referenced Fire Standards

The source of test procedures listed in Table 1 are as follows:

- (1) Leaching Resistance of Cloth, FED-STD-191A—Textile Test Method 5830  
Available from: General Services Administration, Specifications Division, Bldg. 197, Washington Navy Yard, Washington, DC 20407
- (2) Federal Aviation Administration Vertical Burn Test, FAR-25.853  
Available from: U.S. Government Printing Office, Washington, DC 20402
- (3) American Society for Testing Materials (ASTM)
  - (a) Specification for Gaskets, ASTM C-542
  - (b) Surface Flammability of Flexible Cellular Materials Using a Radiant Heat Energy Source ASTM D-3675
  - (c) Fire Tests of Building Construction and Materials, ASTM E-119
  - (d) Surface Flammability of Materials Using a Radiant Heat Energy Source, ASTM E-162  
Available from: American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103
- (4) National Fire Protection Association (NFPA)
  - (a) Flooring Radiant Panel Test, NFPA-253
  - (b) Smoke Generated by Solid Materials, NFPA-258  
Available from: National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

- (5) American Association of Textile Chemists and Colorists, Test (AATCC-86)

Available from: American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709

- (6) Electrical Insulation Fire Characteristics, Volume I: Flammability Tests, UMTA-MA-06-0025-79-1, PB-294 840/4WT

Electrical Insulation Fire Characteristics, Volume II: Toxicity, UMTA-MA-06-0025-79-2, PB-294 841/4WT

Available from: The National Technical Information Service, Springfield, VA 22161

In all instances the most recent issue of the document or the revision in effect at the time of request should be employed in the evaluation of the materials specified herein.

### Definition of Terms

1. Critical Radiant Flux (CRF) as defined in NFPA 253 is a measure of the behavior of horizontally mounted floor covering systems exposed to flaming ignition source in a graded radiant heat energy environment in a test chamber.

2. Flame spread index (I) as defined in ASTM E-162 is a factor derived from the rate of progress of the flame front (F) and the rate of heat liberation by the material under test (Q), such that  $I = F \cdot Q$ .

3. Special optical density (D) as defined in NFPA 258 is the optical density measured over unit path length within a chamber of unit volume, produced from a specimen of unit surface area, that is irradiated by a heat flux of 2.5 watts/cm<sup>2</sup> for a specified period of time.

4. Surface flammability denotes the rate at which flames will travel along surfaces.

5. Flaming running denotes continuous flaming material leaving the site of material burning or material installation.

6. Flaming dripping denotes periodic dripping of flaming material from the site of material burning or material installation.

7. Light rail transit (LRT) vehicle means a streetcar-type transit vehicle operated on city streets, semi-private rights-of-way, or exclusive private rights-of-way.

8. Rail rapid transit (RRT) vehicle means a subway-type transit vehicle operated on exclusive private rights-of-way with high-level platform stations.

### Recommended Test Procedures and Performance Criteria

(a) The materials used in RRT and LRT vehicles should be tested according to the procedures and performance criteria set forth in Table 1.

(b) Transit properties should require certification that combustible materials to be used in the construction of vehicles have been tested by a recognized independent testing laboratory, and that the results are within the recommended limits.

(c) Although there are no Recommended Fire Safety Practices for electrical insulation materials, information pertinent to the selection and specification of electrical insulation for use in transit fire environments is contained in the following UMTA reports:

1. Electrical Insulation Fire Characteristics, Volume I, Flammability Tests, December 1978.

2. Electrical Insulation Fire Characteristics, Volume II, Toxicity, December 1978.

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### Notes

1. Materials tested for surface flammability should not exhibit any flaming running, or flaming dripping.

2. Flammability and smoke emission characteristics should be demonstrated to be permanent by washing, if appropriate, according to FED-STD-191A Textile Test Method 5830.

3. Flammability and smoke emission characteristics should be demonstrated to be permanent by dry-cleaning, if appropriate, according to AATCC-86. Materials that cannot be washed or dry cleaned should so be labeled and should meet the applicable performance criteria after being cleaned as recommended by the manufacturer.

4. For double window glazing, the interior glazing should meet the materials requirements specified herein, the exterior glazing need not meet those requirements.

5. NFPA-258 maximum test limits for smoke emission (specific optical density) should be measured in either the flaming or non-flaming mode, depending on which mode generates the most smoke.

6. Structural flooring assemblies should meet the performance criteria during a nominal test period determined by the transit property. The nominal test period should be twice the maximum expected period of time, under normal circumstances, for a vehicle to come to a complete, safe stop from maximum speed, plus the time necessary to evacuate all passengers from a vehicle to a safe area. The nominal test period should not be less than 15 minutes. Only one specimen need be tested.

7. Carpeting should be tested in accordance with NFPA-253 with its padding, if the padding is used in actual installation.

Issued on: November 17, 1982.

Arthur E. Toole, Jr.,

Administrator.

[FR Doc. 83-32182 Filed 11-24-82; 8:46 am]

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TABLE 1. RECOMMENDATIONS FOR TESTING THE FLAMMABILITY AND SMOKE EMISSION CHARACTERISTICS OF TRANSIT VEHICLE MATERIALS

Category	Function of Material	Test Procedure	Performance Criteria
Seating	Cushion <sup>1;2;5*</sup>	ASTM D-3675	$I_s \leq 25$
		NFPA 258	$D_s(1.5) \leq 100; D_s(4.0) \leq 200$
	Frame <sup>1;5</sup>	ASTM E-162	$I_s \leq 35$
		NFPA 258	$D_s(1.5) \leq 100; D_s(4.0) \leq 200$
	Shroud <sup>1;5</sup>	ASTM E-162	$I_s \leq 35$
		NFPA 258	$D_s(1.5) \leq 100; D_s(4.0) \leq 200$
Panels	Wall <sup>1;5</sup>	ASTM E-162	$I_s \leq 35$
		NFPA 258	$D_s(1.5) \leq 100; D_s(4.0) \leq 200$
	Ceiling <sup>1;5</sup>	ASTM E-162	$I_s \leq 35$
		NFPA 258	$D_s(1.5) \leq 100; D_s(4.0) \leq 200$
	Partition <sup>1;5</sup>	ASTM E-162	$I_s \leq 35$
		NFPA 258	$D_s(1.5) \leq 100; D_s(4.0) \leq 200$
	Windscreen <sup>1;5</sup>	ASTM E-162	$I_s \leq 35$
		NFPA 258	$D_s(1.5) \leq 100; D_s(4.0) \leq 200$
	HVAC Ducting <sup>1;5</sup>	ASTM E-162	$I_s \leq 35$
		NFPA 258	$D_s(4.0) \leq 100$
	Window <sup>4;5</sup>	ASTM E-162	$I_s \leq 100$
		NFPA 258	$D_s(1.5) \leq 100; D_s(4.0) \leq 200$
	Light Diffuser <sup>5</sup>	ASTM E-162	$I_s \leq 100$
		NFPA 258	$D_s(1.5) \leq 100; D_s(4.0) \leq 200$
Flooring	Structural <sup>6</sup>	ASTM E-119	Pass
	Covering <sup>7</sup>	NFPA 253	C.R.F. $\geq 0.5w/cm^2$
Insulation	Thermal <sup>1;2;5</sup>	ASTM E-162	$I_s \leq 25$
		NFPA 258	$D_s(4.0) \leq 100$
	Acoustic <sup>1;2;5</sup>	ASTM E-162	$I_s \leq 25$
		NFPA 258	$D_s(4.0) \leq 100$
Miscellaneous	Elastomers <sup>1</sup>	ASTM C-542	Pass
	Exterior Shell <sup>1;5</sup>	ASTM E-162	$I_s \leq 35$
		NFPA 258	$D_s(1.5) \leq 100; D_s(4.0) \leq 200$
	Component Box covers <sup>1;5</sup>	ASTM E-162	$I_s \leq 35$
		NFPA 258	$D_s(1.5) \leq 100; D_s(4.0) \leq 200$

\*Refers to Notes on Table 1.

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**APPENDIX I**  
**AMTRAK SELF-CERTIFICATION FORM**  
**SUPERINTENDENT'S NOTICE**

Attention: Conductors  
Engineers  
Yard Foreman

Effective immediately, conductors and/or yard foremen on all crews will personally check each crew member, including those on the engine crew when practical, as soon as possible after the crew assumes duty to ensure that they are not in violation of Rule G of the Rules and Regulations of the Southern Pacific Transportation Company. When the conductor does not have an opportunity to check the engine crew, also on helper crews without conductors, the locomotive engineer will check his fireman/helper, if any.

Conductors/yard foremen and/or engineer will similarly check each crew member at the conclusion of each trip or tour of duty.

A Form, sample indicated below, is to be used by conductors/yard foreman and/or engineers to certify that crew members, including himself, are not in violation of Rule G indicating the time and date the checks were made at beginning and end of tour of duty.

I, \_\_\_\_\_, certify that I am not  
Conductor, Engineer, Yard Foreman, Run No.,  
in violation of Rule G of the Rules and Regulations of the Southern Pacific  
Transportation Company and that \_\_\_\_\_  
\_\_\_\_\_ are not in violation of Rule G.

(Include in the space above the names of crew members who were checked, i.e., engineer, fireman, helper, brakeman, switchman, TBM)

Time

Date

Signature

2018

X  
**NATIONAL EMERGENCY  
TRAINING CENTER  
LEARNING RESOURCE CENTER  
16825 SOUTH SETON AVENUE  
EMMITSBURG, MD 21727**

**NETC LRC**



**002252**

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